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(54) Vehicle fleet monitoring apparatus

(57) A data monitoring apparatus, for example, for the monitoring of fleet vehicles such as trucks.
The monitoring apparatus comprises a vehicle mounted data capture device (5) for collecting data, a plurality of data input means (7) for monitoring parameters of the vehicle, and a data analyser (20) for analyzing data associated with the monitored vehicle. Data related to the performance of a moving vehicle can be monitored at a remote site via a communications link (11, 60, 21).

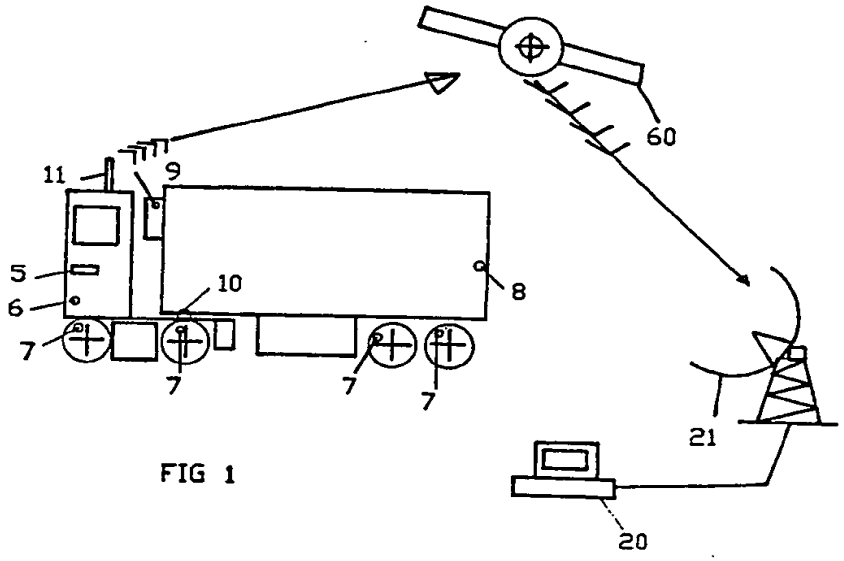

FIG 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

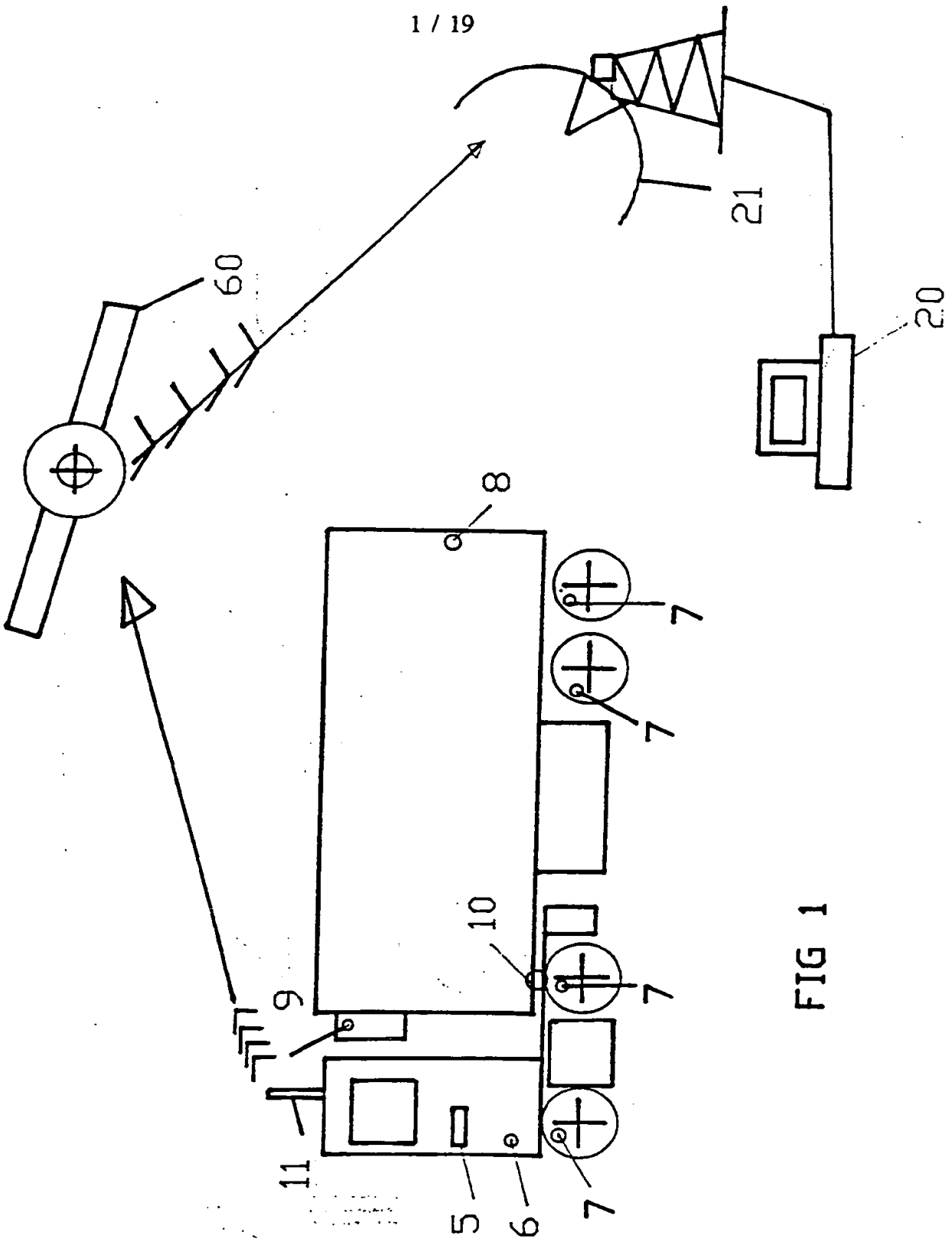
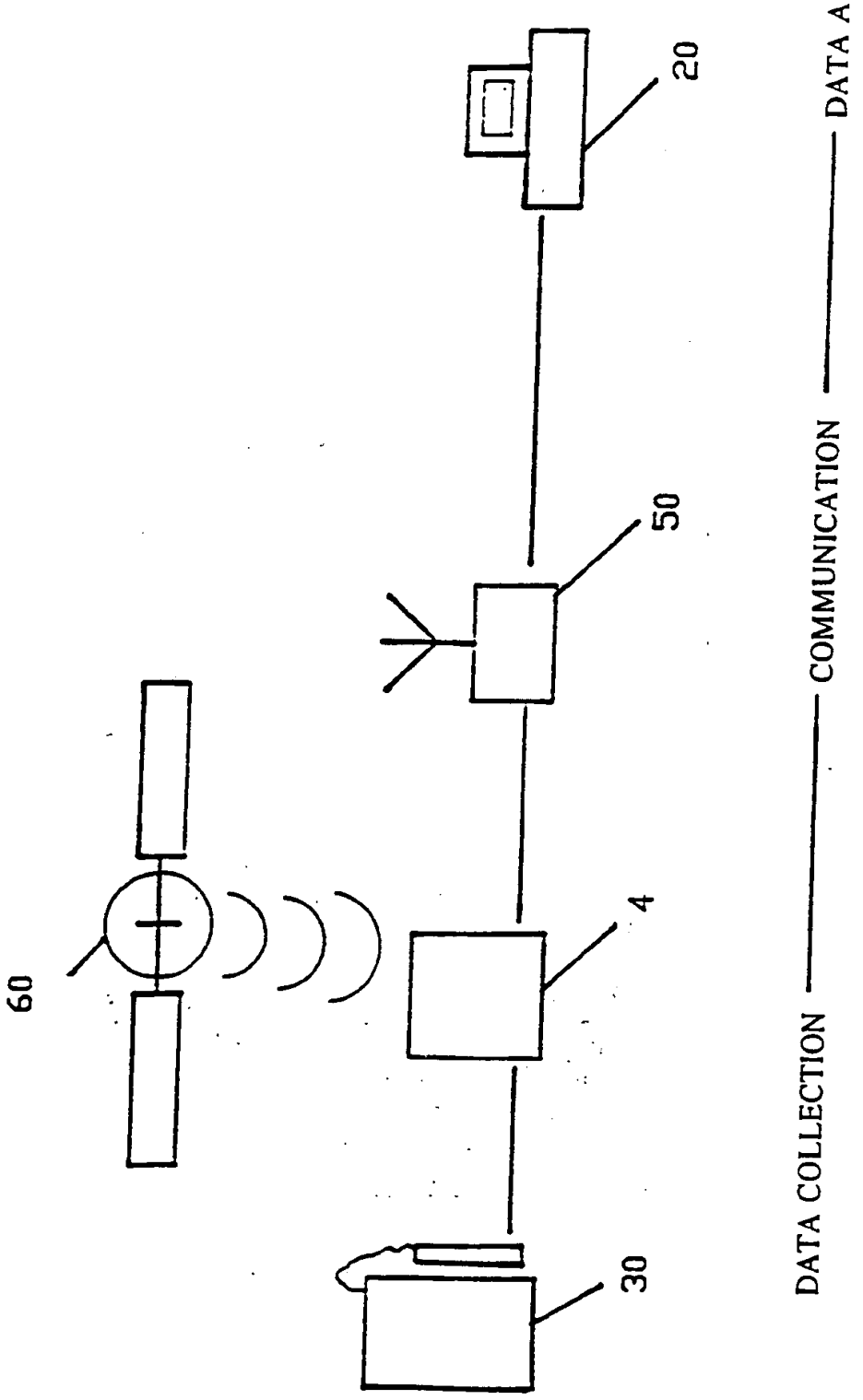


FIG 1

FIG 2



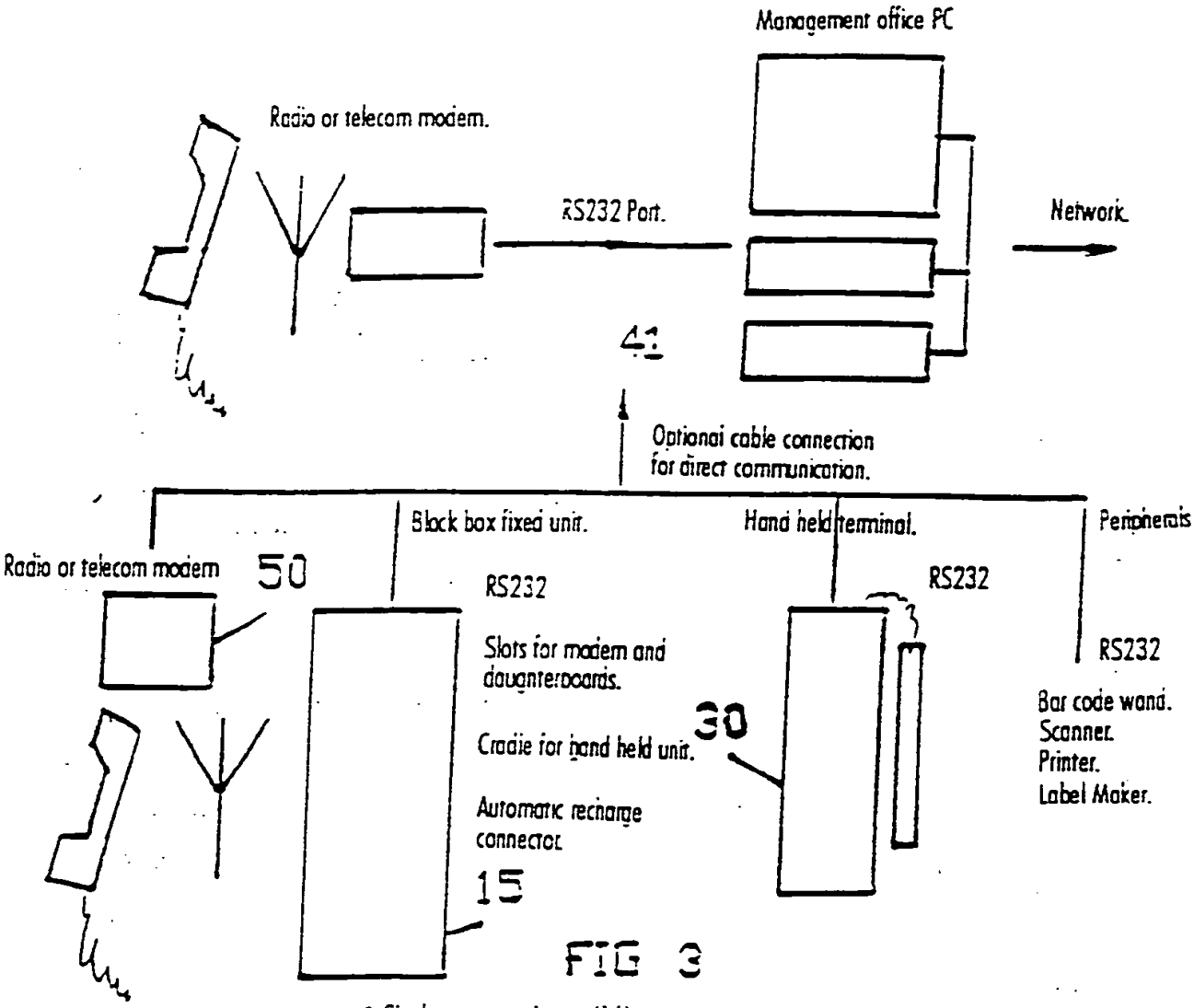


FIG 3

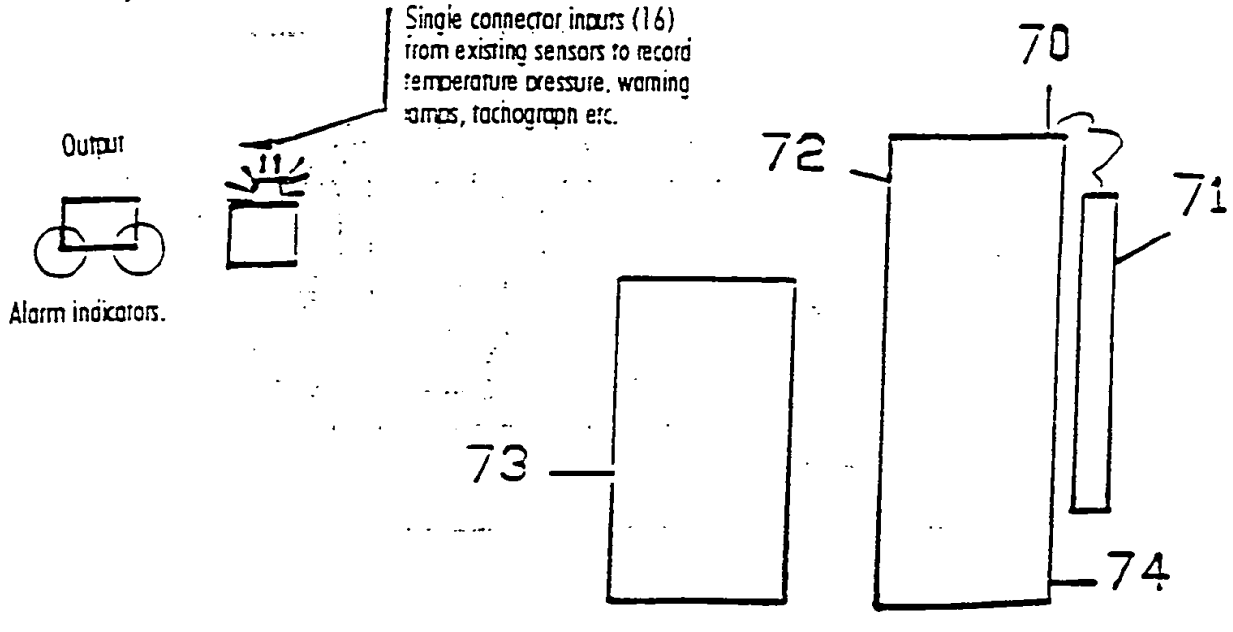
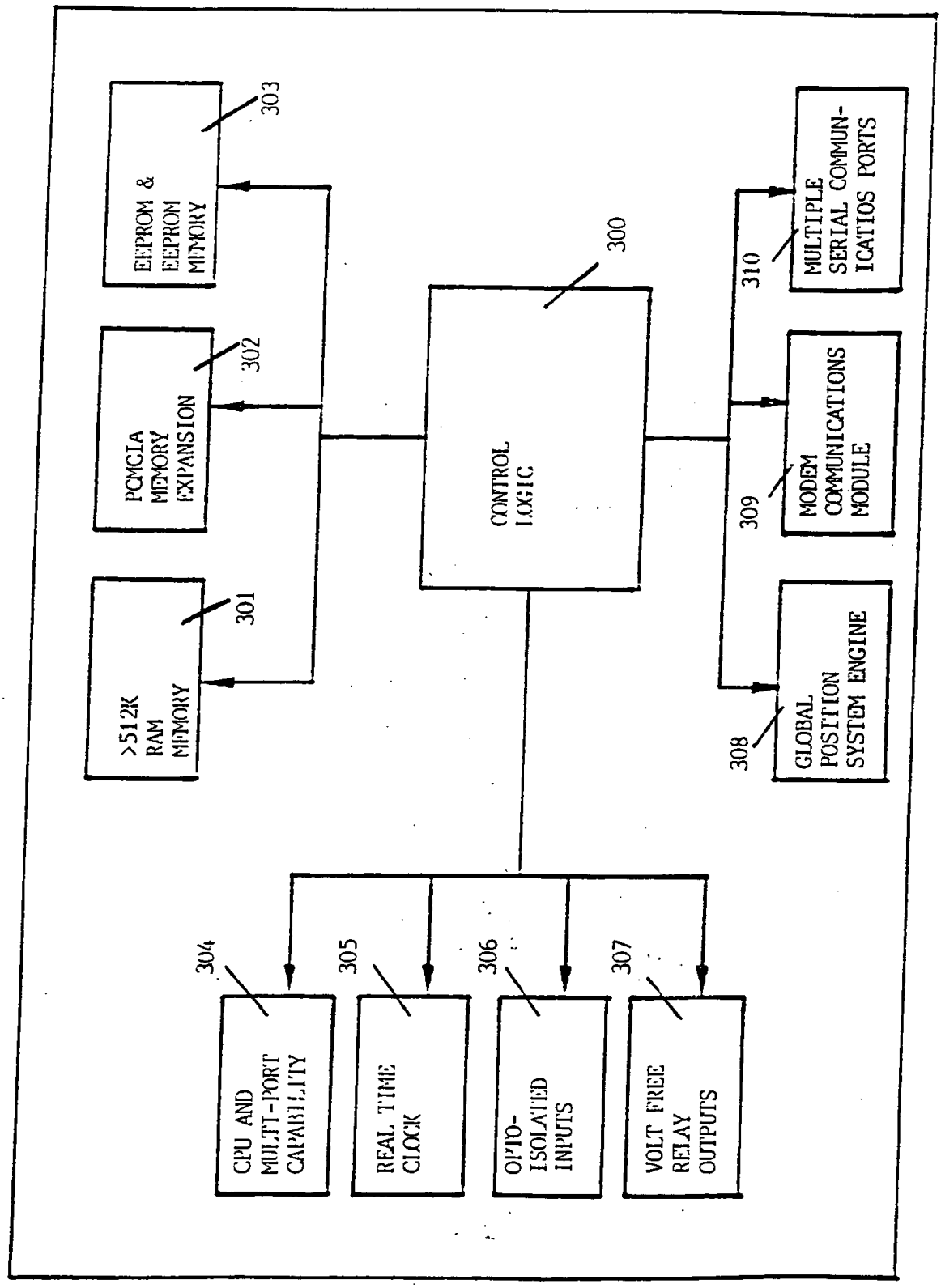
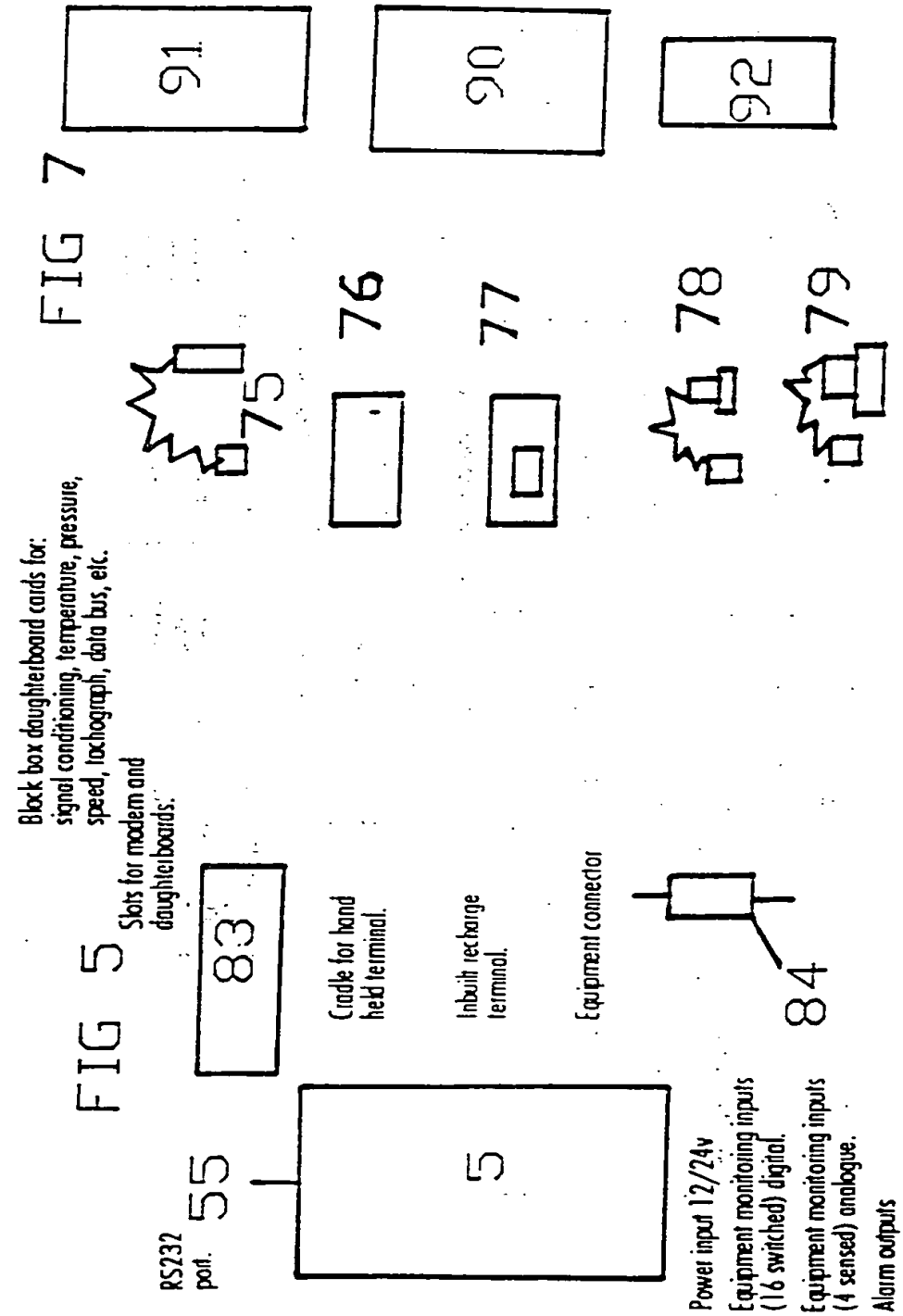


FIG 6

FIG 4

Chronicle Data Capture Unit
Hardware Components





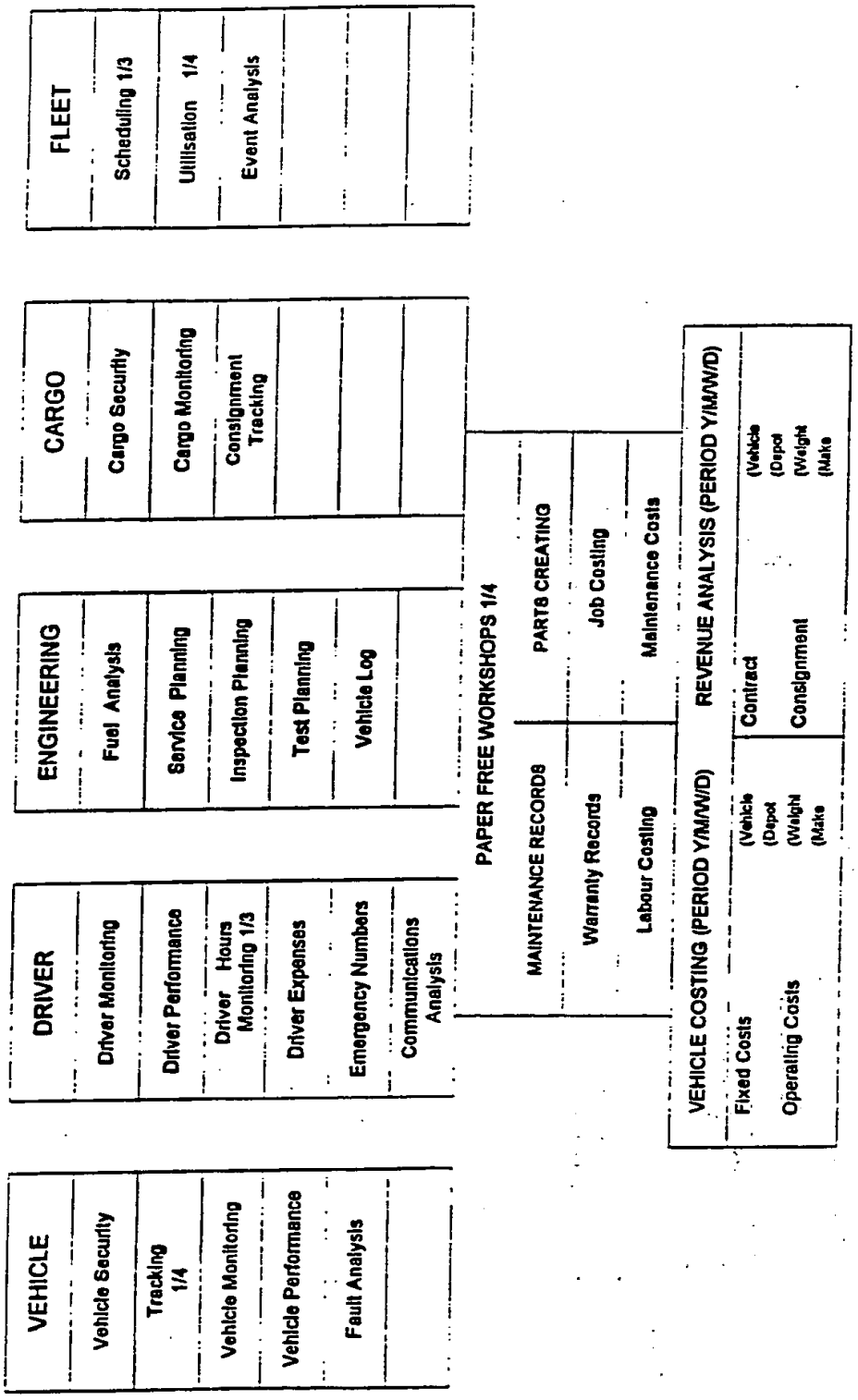


FIG. 8.

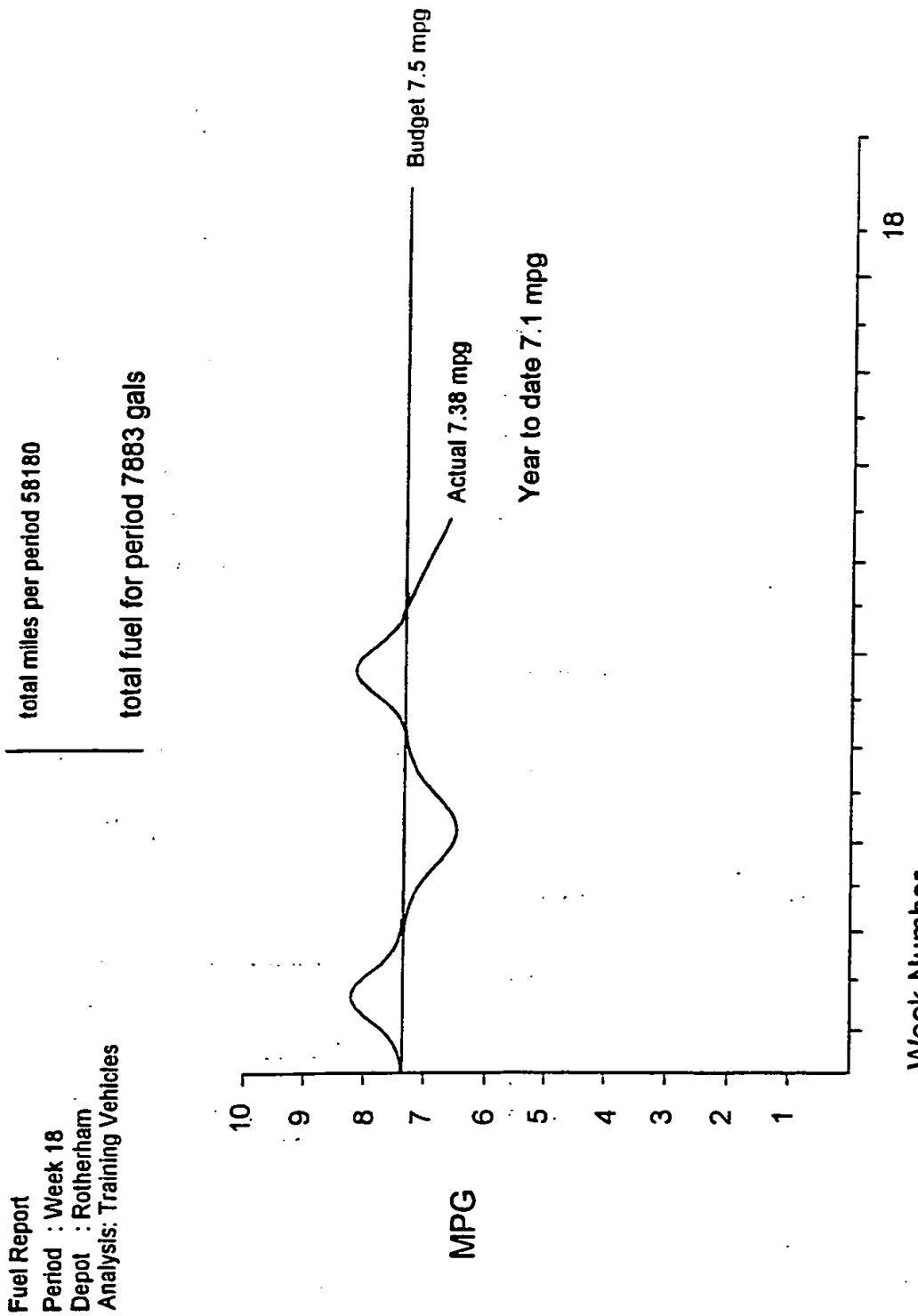


FIG. 9.

FIG 10

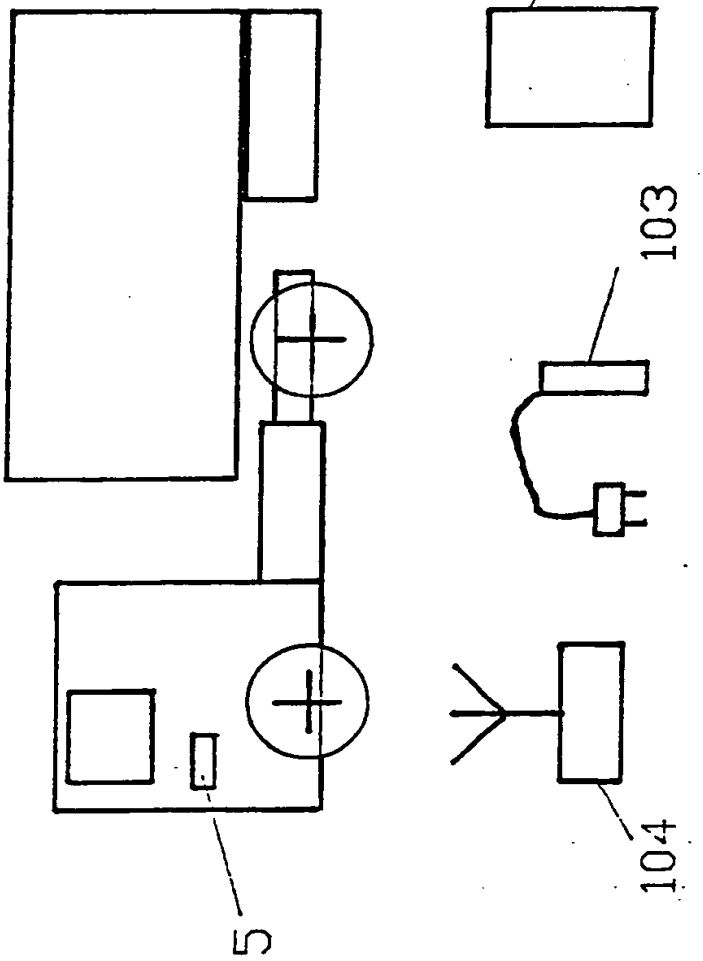


FIG 11

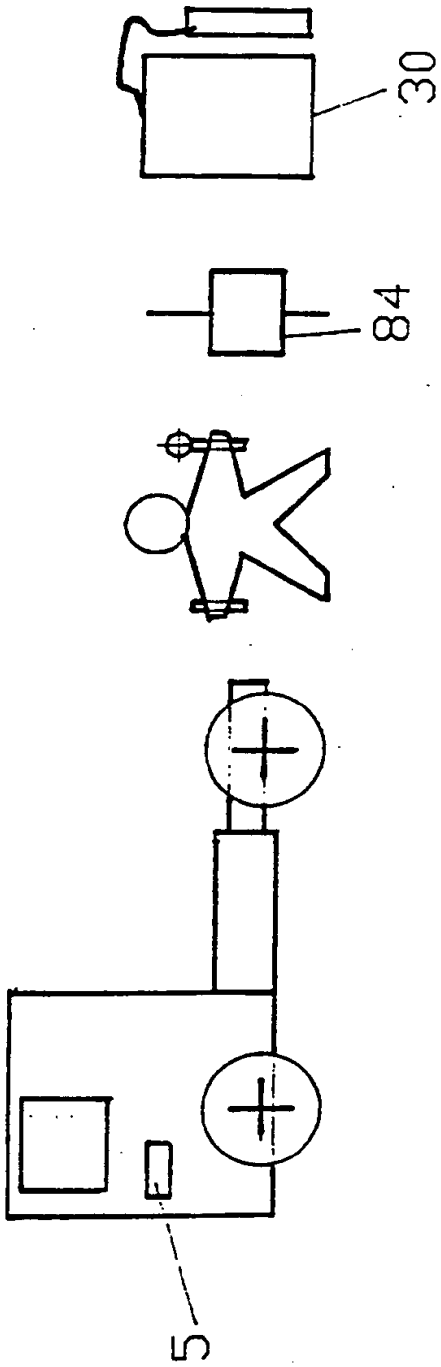


FIG 12

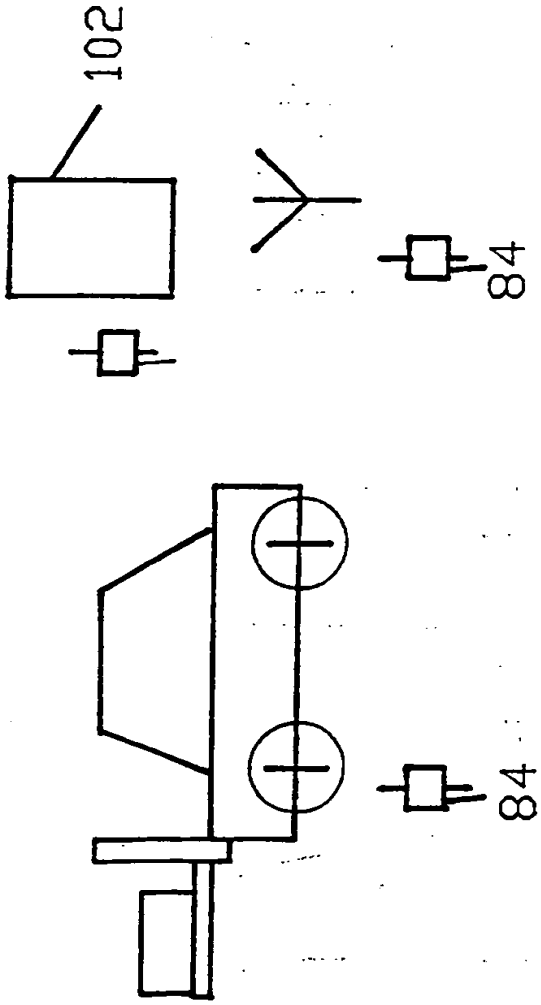
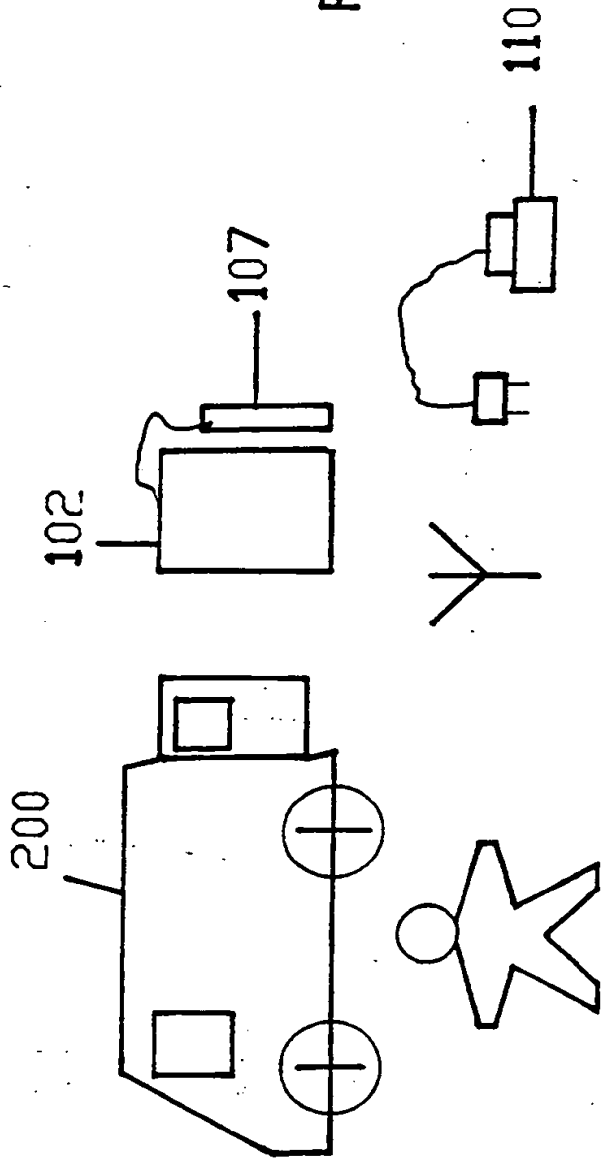


FIG 13



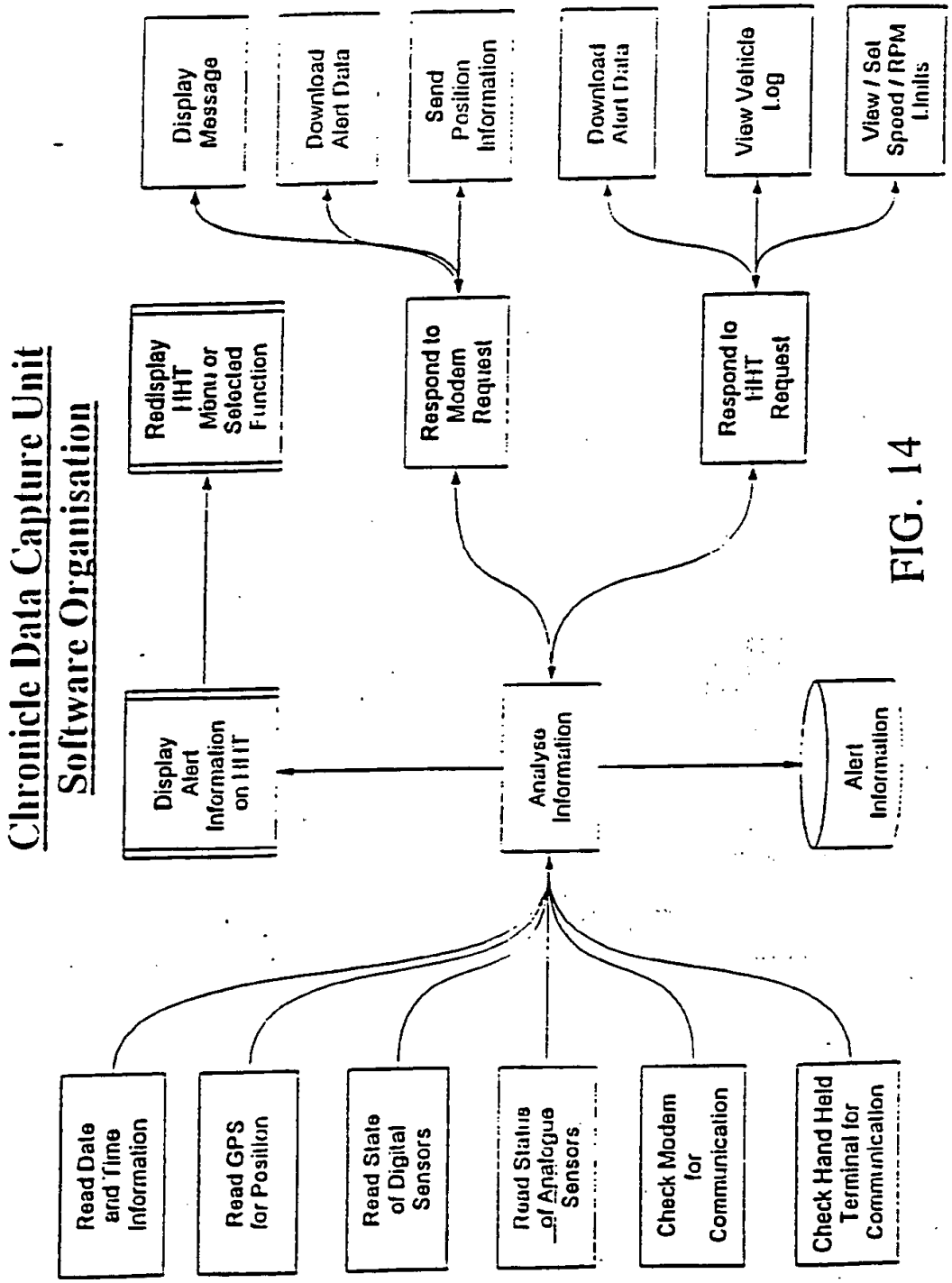


FIG. 14

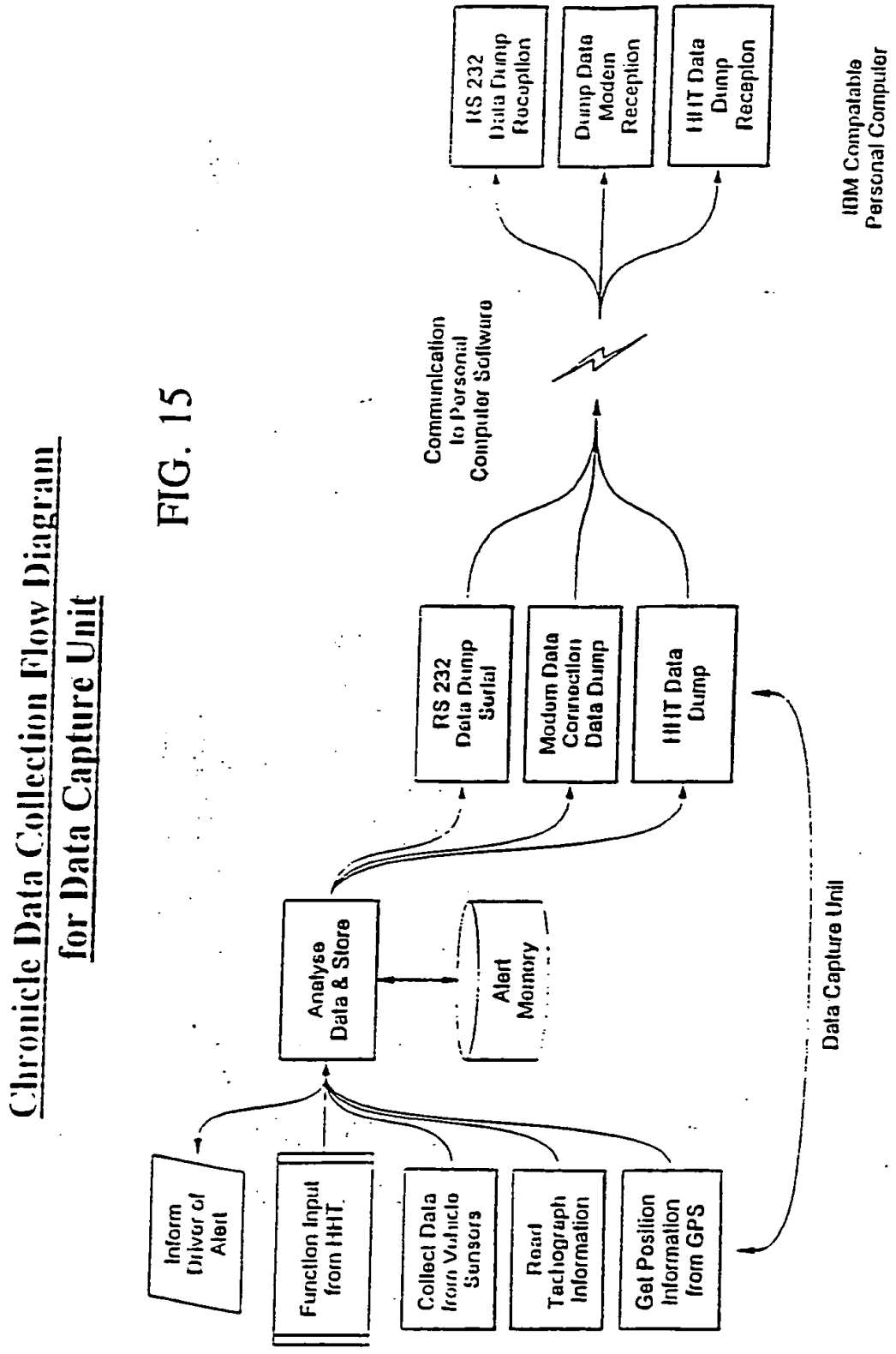
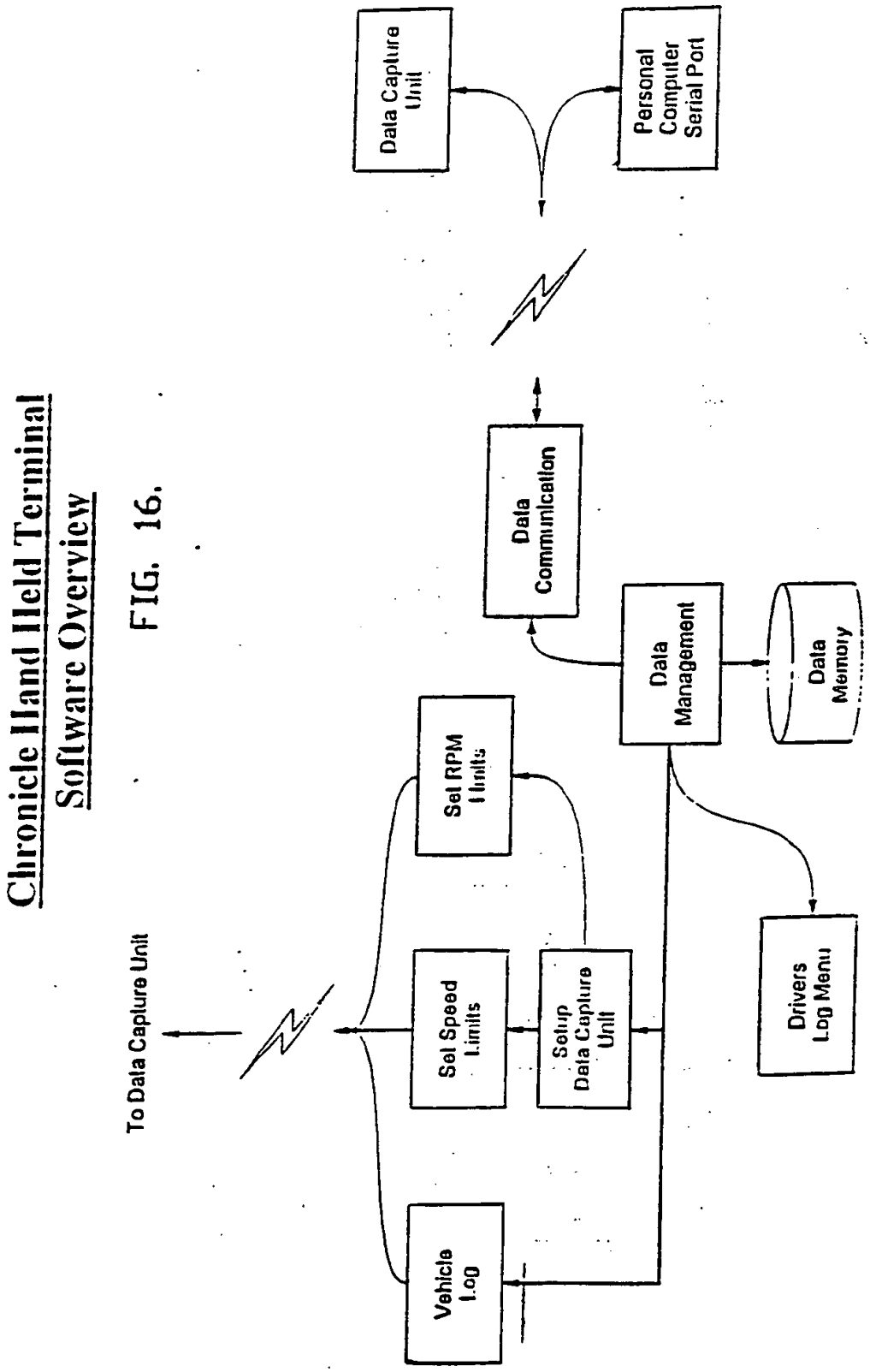


FIG. 15



Chronicle Hand Held Terminal
Software Overview

FIG. 16.

FIG. 17. Chronicle Hand Held Terminal
Drivers Log Software Overview

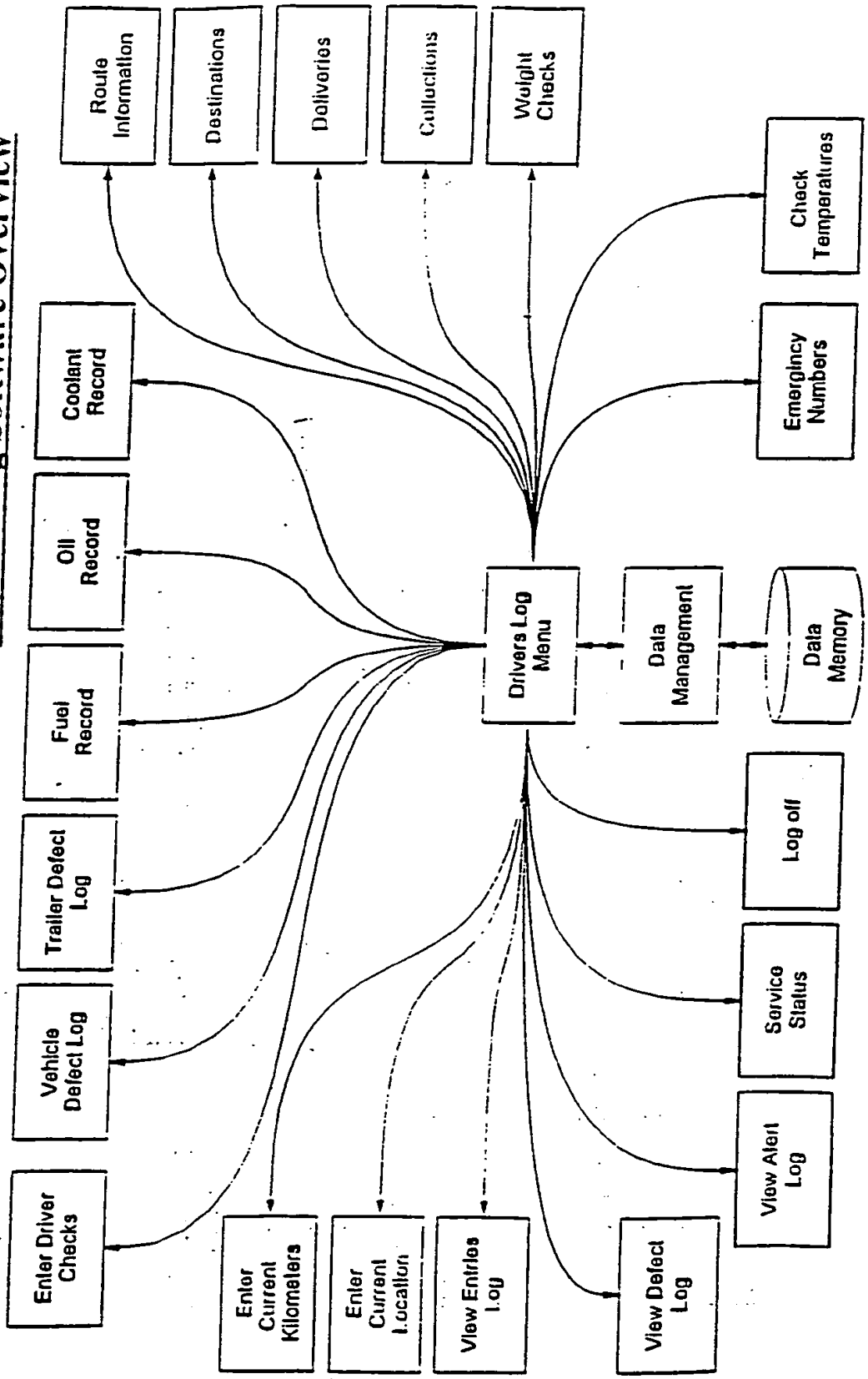
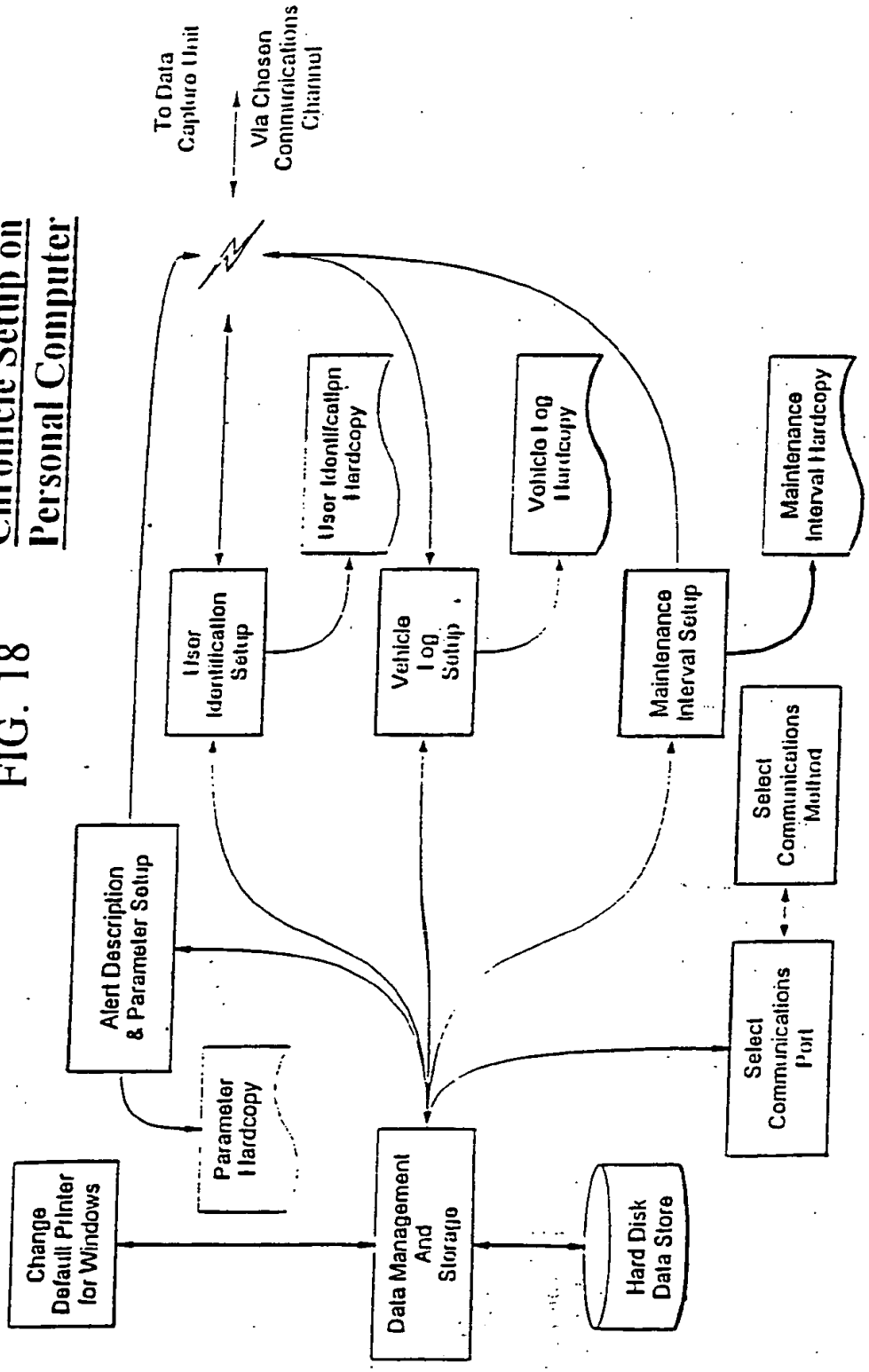
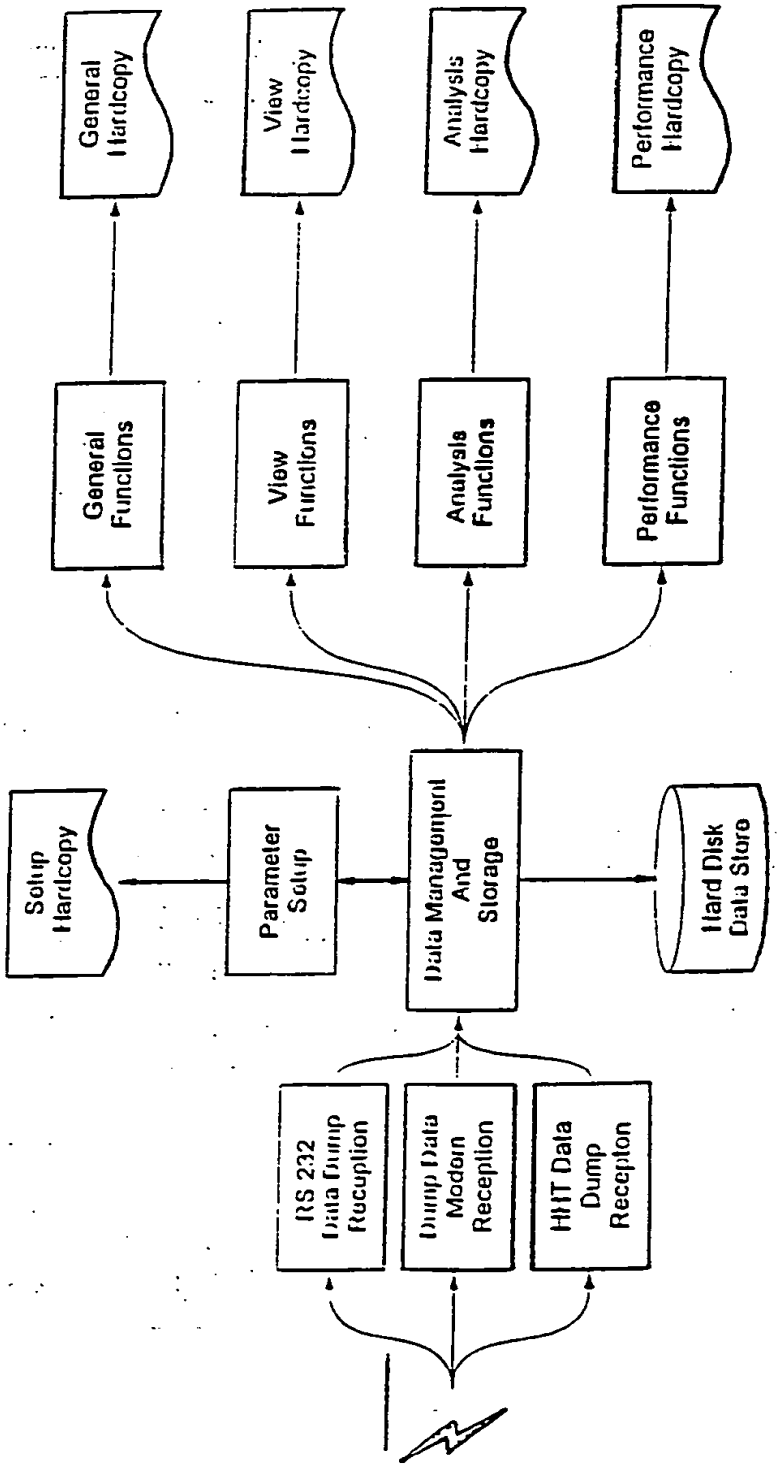


FIG. 18 Chronicle Setup on Personal Computer



Chronicle Data Analysis on Personal Computer

FIG. 19



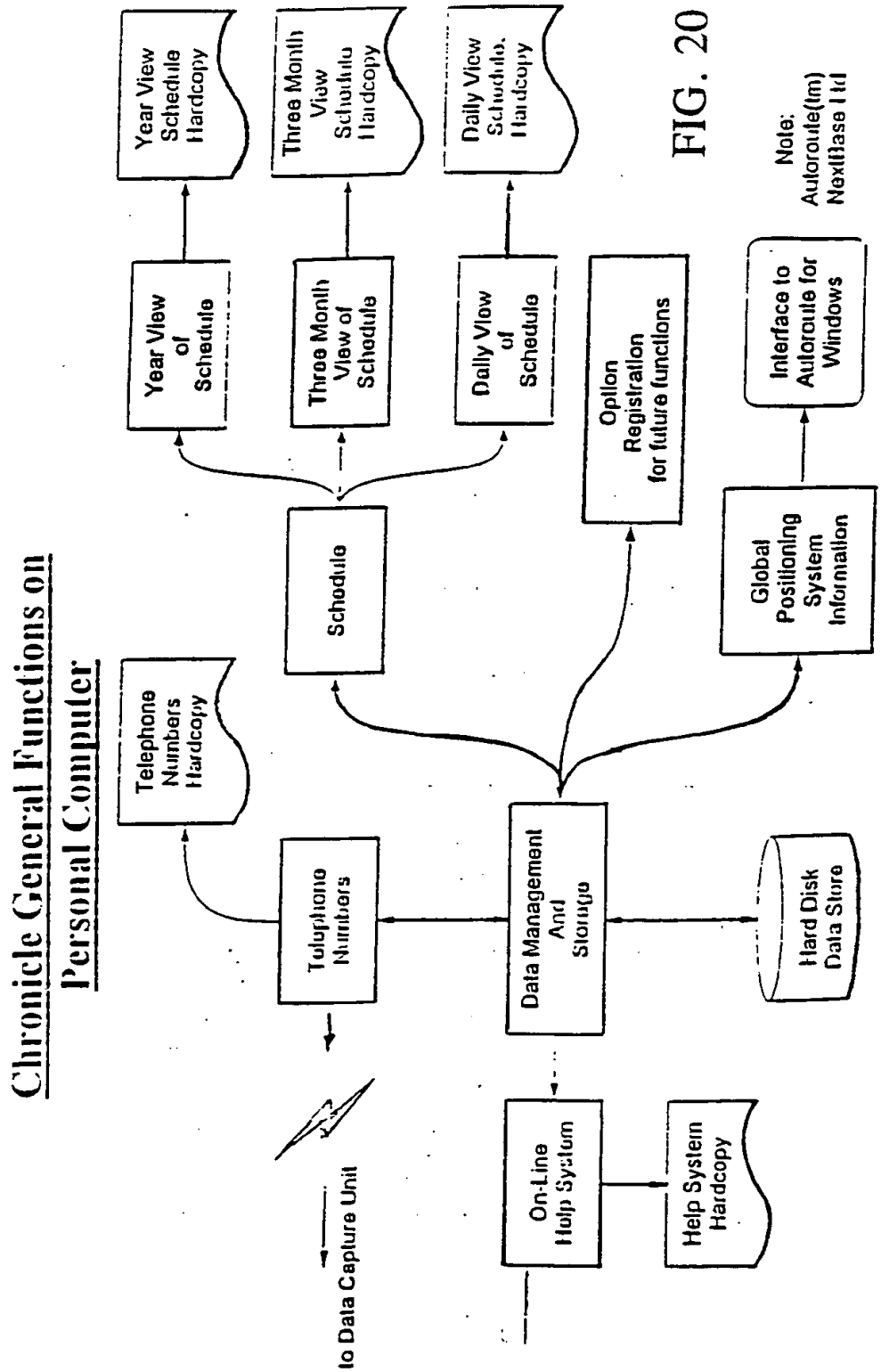
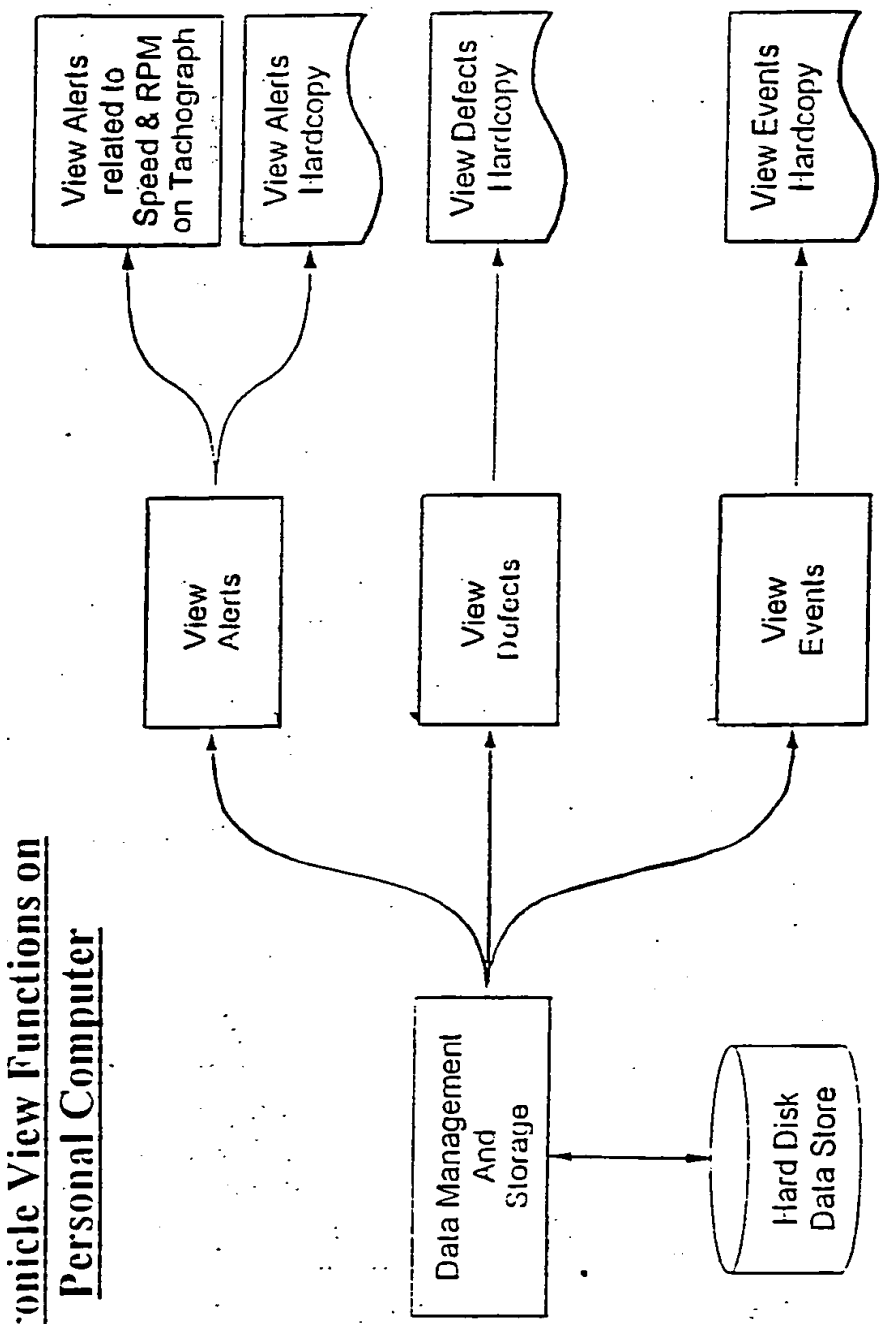


FIG. 20

FIG. 21.



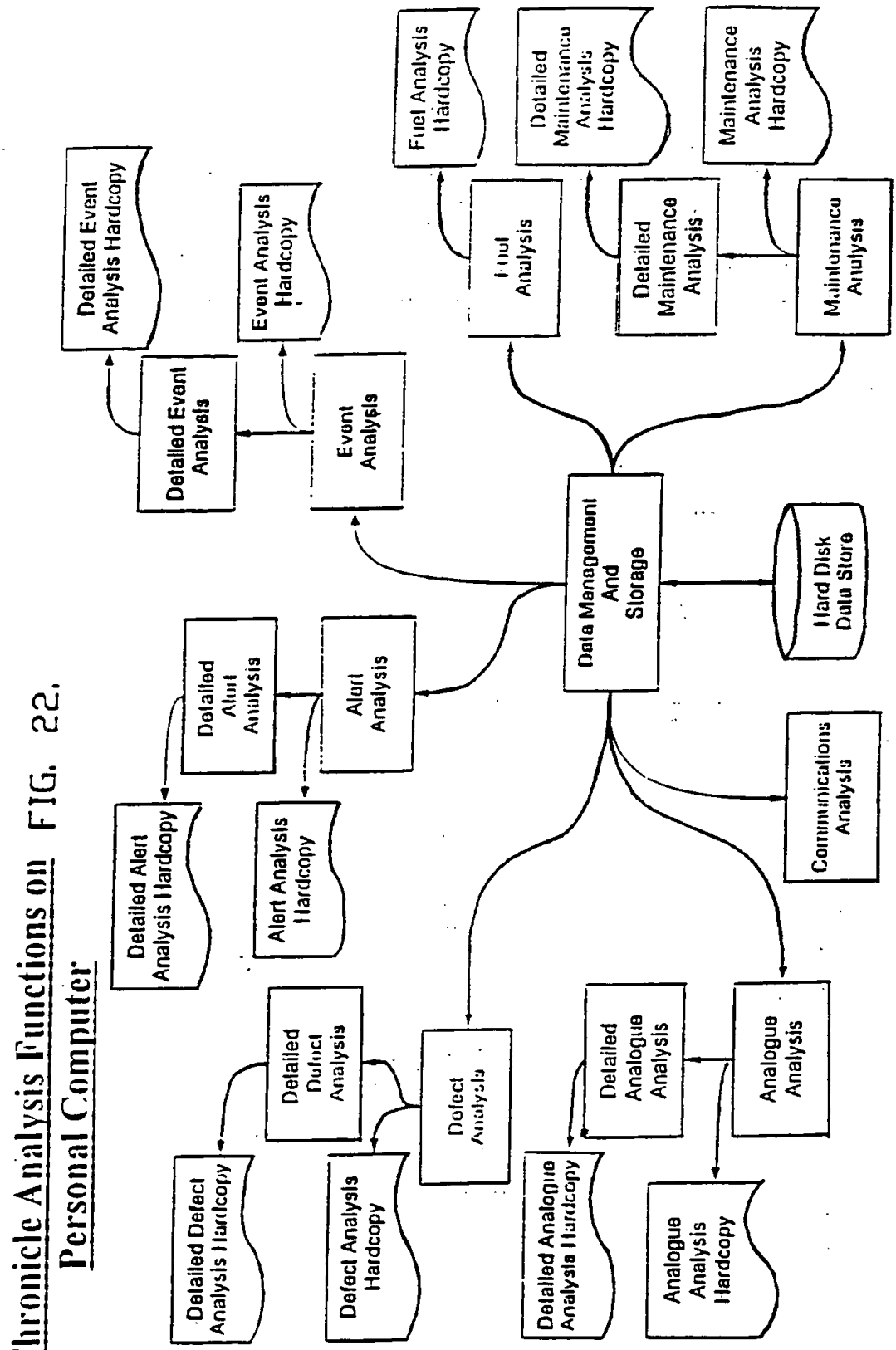
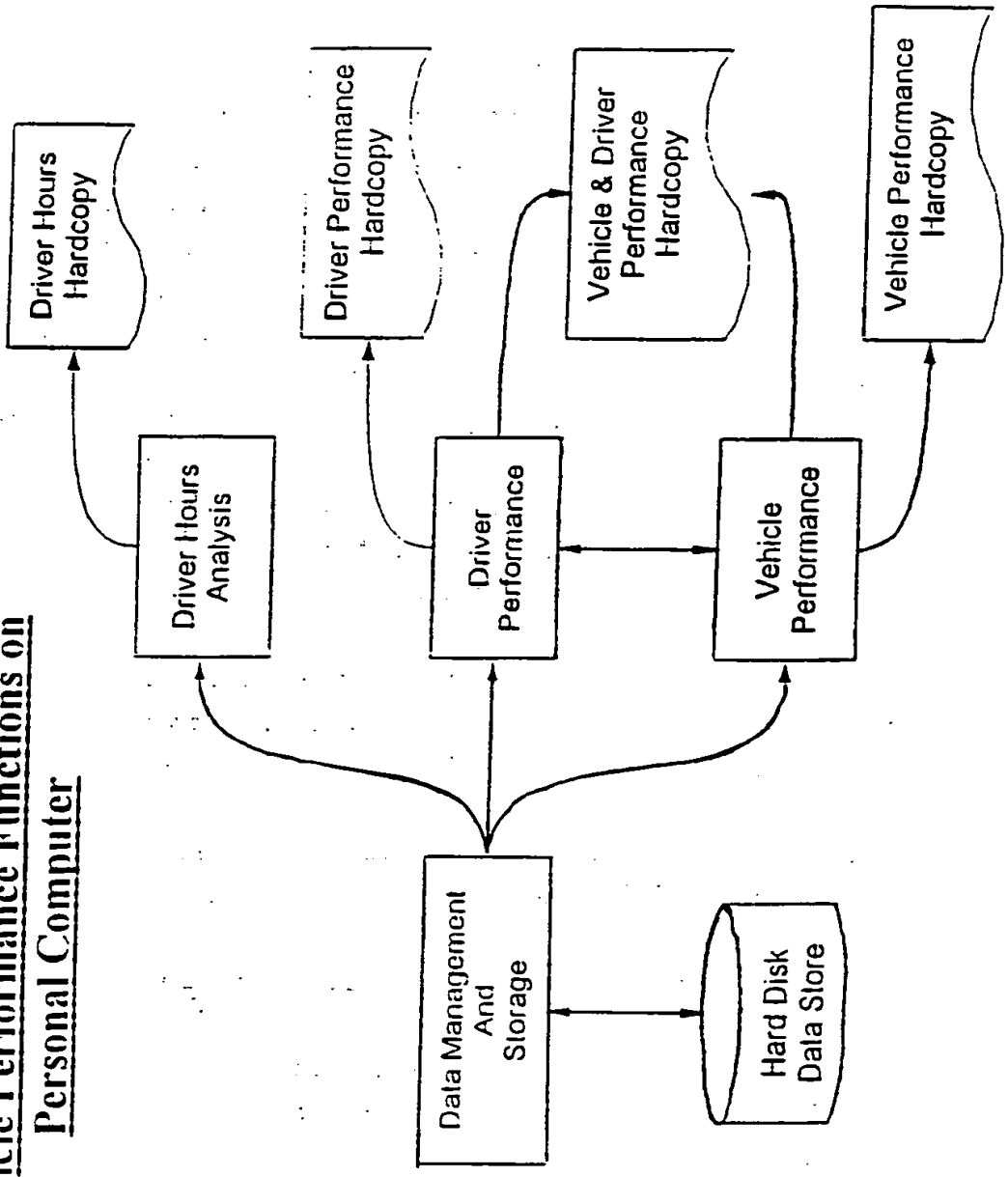


FIG. 22.

FIG.23.

Chronicle Performance Functions on Personal Computer



VEHICLE FLEET MONITORING APPARATUS

The present invention relates to monitoring apparatus.

Conventionally a manager of a fleet of transport vehicles, for example a fleet of articulated lorries, wishes to monitor parameters relating to the vehicle such as miles per gallon, whether the vehicle has broken down, location of a vehicle, any technical problems associated with the vehicle, or whether the vehicle is loaded/unloaded. To assist in such management, there are available known computer programs for use on personal computers, into which such parameters as miles per gallon etc. can be typed for each vehicle. Flow charts, graphs or other analyses of vehicle performance for one or more vehicles in the fleet may then be produced.

One object of the present invention is to provide apparatus and methods which enable improvement of the management of one or more vehicles in a fleet.

According to one aspect of the present invention there is provided a data monitoring apparatus comprising:

a data capture device for collecting data;

one or a plurality of data input means for inputting data into the data capture device; and

a data analyser device for analysing data collected by the data capture device.

Preferably the data monitoring apparatus further comprises a communications link for communicating data

between the data capture device and the data analyser device.

Preferably the data monitoring apparatus is arranged to monitor data relating to one or a plurality of vehicles.

Preferably the data monitoring apparatus is capable of providing real time monitoring of data by:

(i) the data capture unit substantially continuously receiving data from one or a plurality of said data input means; and

(ii) communications of collected data between the data capture device and the data analyser device occurring substantially continuously, and/or at discrete time intervals.

Preferably said time intervals are periodic.

Preferably, the data or monitoring apparatus is arranged such that data is automatically input to said data capture means by said input means, and said communications between the data capture device and the data analyser device occur automatically.

Preferably the data capture device is preset with a set of data ranges each data range corresponding to a parameter, the data capture device being arranged such that when a parameter data is received which is outside the preset range of data for that particular parameter, the received parameter data is communicated between the data capture device and the analyser device.

The data capture device is preferably capable of storing a set of vehicle specifications, corresponding to a vehicle to which the data capture device may be fitted.

Preferably the data input means comprises a keypad terminal connectable to the data capture device by means of a databus.

There may be provided a display screen for displaying information transmitted between the keypad and data capture device.

The data input means may comprise a bar code reader.

The data input means may comprise a portable personal computer or computer memory storage means.

Preferably the data input means comprises one or a plurality of sensors for sensing any one or more of the following physical parameters: pressure; temperature; speed; acceleration; deceleration; stress; strain; current; voltage; vibration; position; fuel level; oil level; coolant level; time; engine running hours; driver hours; security.

Preferably the data capture device is arranged to receive a plurality of sensor signals from one or a plurality of said parameter sensors.

Preferably the data capture device comprises a casing; a micro-processor; at least one memory; and an input/output terminal.

Preferably the data capture device is adapted for fitment to a vehicle, preferably a goods vehicle. However, the data capture device is not necessarily so adapted. The device may be adapted for monitoring of an industrial or medical equipment.

Preferably the data capture device is provided with an internal electrical power supply unit so that the data capture device may be powered independently of a general electrical power supply circuit of a vehicle to which the data capture device is fitted. A memory of the data capture device may be supported by the internal power supply for a period of the order of five years.

Preferably the monitoring apparatus comprises a means for determining a vehicle position.

Preferably the data analyser comprises a computer programmed for transmission of data to the data capture device via the communication link, and for receipt of data transmitted from the data capture device over the communications link; wherein the computer is arranged to automatically generate an alert message, if a collected parameter data is outside a preset range of parameter data limits. Such a feature may be called "Macro messaging".

Preferably, all alert messages are recorded, and for each alert message, a time and date of the alert message is recorded.

The communications link may comprise a conventional cellular telephone network link. The link may comprise an error correction and data compression modem for onward transmission of collected data.

The invention includes a data monitoring apparatus for a fleet of vehicles, the apparatus comprising:

a plurality of data capture devices provided one or more per each vehicle;

a plurality of data input means, at least one data input means per each vehicle, for entering data into the data capture devices;

a data analyser device; and

a communications link having a plurality of channels between the data analyser device and the data capture devices.

According to a second aspect of the present invention, there is provided a method of monitoring a set of data parameters relating to one or a plurality of vehicles, the method comprising the steps of:

(i) pre-determining a set of data ranges, each range corresponding to a respective parameter;

(ii) reading a parameter data;

(iii) comparing said read parameter data with the corresponding range of data which has been predetermined for that particular parameter; and

(iv) if a said read parameter data is outside said predetermined data range, generating a signal to notify that said parameter data is an exceptional parameter data.

Preferably, when a said read parameter data falls outside a said corresponding predetermined range, indicating said parameter data is an exceptional parameter data, said exceptional parameter data is communicated between a vehicle and a remote site.

The invention includes a method of operating a data monitoring apparatus according to the above mentioned first aspect, the method including the steps of controlling a data capture device to:

(a) read any one or more of the following: date and time information; ground position information; state of digital sensor information; state of analogue sensor information; and/or

(b) check a modem for a communication and/or checking a hand held terminal for a communication; and/or

(c) analyse said information or communication, and depending upon a result of said analysis, displaying an Alert signal or responding to the modem communication, and/or responding the hand held terminal communication.

The invention includes a method of operating a data monitoring apparatus according to the first aspect, the method comprising the steps of controlling a hand held terminal input means to:

(d) view or enter information relating to a status of a monitored vehicle, via a log menu program; or

(e) set up preset data parameters on the data capture device.

The invention includes a method of operating a data monitoring apparatus according to the first aspect, the method comprising the steps of operating the data analyser device to:

(f) receive and/or communicate data to the data capture device via the communications channel; and

(g) set up preset parameters on the data capture device from the data analyser device, said preset parameters including any one or more of the following: an Alert description and parameter set up; a user identification set up; a vehicle log set up; a maintenance interval set up; a selector communications port set up.

The invention includes a method of operating a data monitoring apparatus according to the first aspect comprising the steps of:

(h) operating the data analyser device to perform a general function, a view function, an analysis function, or a performance function, in which a said general function is selected from a set comprising the members: an on line help program; a telephone number storage and access program; a schedule program; an option registration program; or a global positioning information program; and/or

(i) operating the data analyser device to select a view function from a set comprising the members: a view Alert function; a view Defect function; a view Event function and the analysis function is selected from a set comprising the members: a communications analysis function; an analogue analysis function; a Defect analysis function; an Alert analysis function; an Event analysis function; a fuel analysis function; a maintenance analysis function; and/or

(j) operating the data analyser device to select a performance function from a set comprising the members: a driver hours function; a driver performance function; a vehicle performance function; a driver performance and vehicle performance function.

For a better understanding of the invention, and to show how embodiments and methods of the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings, in which:

Figure 1 shows in general view, various features of a vehicle fleet monitoring apparatus, according to a first specific embodiment of the present invention;

Figure 2 shows further details of the fleet monitoring apparatus; illustrating communication between elements of the apparatus in a first configuration;

Figure 3 shows further specific details of the apparatus arranged in a second configuration;

Figure 4 shows schematically main elements of the data capture device of figure 3;

Figure 5 shows schematically data capture device, and optional peripheral components thereof;

Figure 6 shows schematically a hand held terminal comprising part of the apparatus;

Figure 7 shows various optional components of the apparatus;

Figure 8 shows an example of various specific parameters which may monitored by the apparatus;

Figure 9 shows an example data output of the apparatus;

Figure 10 illustrates schematically a first mode of deployment of the apparatus;

Figure 11 illustrates schematically a second mode of deployment of the apparatus;

Figure 12 shows schematically a third mode of deployment of the apparatus;

Figure 13 shows schematically a fourth mode of deployment of the apparatus;

Figure 14 shows schematically a method for controlling the data capture device and an organisation of a computer program for executing the method;

Figure 15 shows schematically a method of operating the data capture device for collection of data;

Figure 16 shows schematically a method for controlling a hend held terminal peripheral device, and an overview of a computer program therefor;

Figure 17 shows schematically a method for controlling a drivers log function in the hand held terminal and an overview of a computer program therefor;

Figure 18 shows schematically a method of operating the data analyser device;

Figure 19 shows a method of operating the data analyser device to perform a data function of the data analyser device;

Figure 20 shows a method of operating the data analyser device to perform a plurality of general functions;

Figure 21 shows a method of operating the data analyser device to perform a set of functions;

Figure 22 shows in general view a method of operating the data analyser device to various analysis functions; and

Figure 23 shows in general view a method of operating the data analyser device to perform various performance functions.

Referring to Figure 1 of the accompanying drawings, a monitoring apparatus for one or a plurality of vehicles

comprises one or a plurality of vehicle mounted data input and data capture equipments, each vehicle being equipped with a separate one of the vehicle mounted equipments; a data analyser 20 for analysing data sensed and collected by the vehicle mounted equipment(s); and a communications link for communicating data between the data analyser and the vehicle mounted equipment(s).

Each vehicle mounted equipment comprises essentially at least one data capture device 5, and an input means for entering data into the data capture device. The input means may comprise a keypad, keyboard, personal computer or hand held terminal, for entering information relating to various conditions of the vehicle or events related to the vehicle, eg. for entering predetermined acceptable data ranges for various parameters, such as travel time, drivers hours, engine run time, fuel consumption, oil pressure, engine temperature; and/or a plurality of sensors for sensing actual data for physical parameters relating to the vehicle, eg. oil pressure, temperature, speed, acceleration time etc. Other examples of conditions or events which may be input to the data capture device are given hereunder.

Data may be collected by the data capture device either by pre-programming of the data capture device, by inputting data into the data capture device via a hand held keyboard terminal, by downloading data into the device from a computer or computer memory storage means, or by inputting data directly from one or a number of the vehicle sensors 6-10 located at various positions around the vehicle for sensing parameters of the vehicle.

The vehicle mounted equipment includes a transmitter and/or receiver 11 for communicating with the data

analyser 20 at a site remote from the vehicle via the communications link.

The communications link preferably but not necessarily comprises a satellite communications link between the vehicle and a ground station 21 eg. a conventional cellular telephone network, the ground station being connectable to the data analyser 20. The communications link may comprise a local radio network or a cell phone network. The data analyser is preferably a personal computer, and may be connected to the ground station over a conventional telephone network.

Hardware items comprising the monitoring apparatus may be categorised into five main elements, these being (i) the data capture device which collects information relating to the vehicle and/or its load, and controls that information, (ii) a hand held terminal, which may be portable, for entering data into the data capture unit, such data may in addition to the above examples, comprise for example a bar code, a delivery note number, a note of fuel used by the vehicle; (iii) a global positioning system (GPS) and apparatus therefor, which may be fitted to the vehicle, and used to give an accurate report on the vehicles position anywhere on earth; (iv) the communications link, over which the data capture device may communicate with the data analyser, allowing transfer of real time information between the data capture unit and the data analyser; and (v) a computer software program for allowing a computer to be programmed to act as the data analyser unit.

A specific embodiment of the monitoring apparatus adapted for monitoring and managing a fleet of trucks and a specific method of operation of the apparatus will now

be described with reference to figures 1 to 11 of the accompanying drawings.

Referring to figures 2 to 5 of the accompanying drawings, the hand held terminal 30, and data capture device 5, are mounted in the cab of the truck. The data capture device comprises a casing, which may be fitted with one or more RS 232 ports for connection to the RS 232 databus; a power input terminal of 7-32 volts DC having an auto ranging facility; a plurality of equipment monitoring inputs, for example 16 switched digital inputs, and 4 sensed analogue inputs; a plurality of alarm outputs, for example 4 open collector outputs, a mother board having capability for connection of a plurality of daughter board cards, each daughter board card being preset to except signals from various inputs, for example a signal conditioning input, a temperature sense input, a pressure sensor input, a speed sensor input, a tachograph sensor input, a databus input; and an equipment connector 84.

Typically the data capture device is in the form of a "black box" casing having a connection 55 for an RS 232 protocol databus 41. The detachable daughter boards, each daughter board being specific to a particular peripheral equipment which attach to the mother board of the data capture device. A selection of daughter boards may be inserted onto the mother board. For example, a daughter board may be inserted for connection of a peripheral radio or telecom modem to the data capture device. A further daughter board may be adapted for connection of the peripheral hand held terminal, for input of data via the hand held terminal into the data capture device. Further daughter boards may be provided, for connection of for example a fax machine, a portable PC, a modem, or a GPS module.

A selection of peripheral equipment items, such as a bar code wand, bar code scanner, a printer, or a label marker, may be attached to the data capture device and/or hand terminal 30 via the RS 232 bus and via an appropriate daughter board. A plurality of single connector inputs, suitably 16 such inputs, are provided to allow connection of existing vehicle sensors provided as part of the vehicle to the data capture device, for example speedometer, oedometer, temperature or pressure sensors, tachograph, or warning lamps.

The data capture device may comprise a micro processor 51, a random access memory 52, a plurality of inputs and outputs 53, for receiving and sending digital and analogue signals; and an EPROM/EEPROM 54.

Referring in particular to figure 4 of the accompanying drawings, one embodiment of data capture device comprises a control logic unit 300, having a memory area including a random access memory 301, a PCMCIA memory expansion device 302, and an EPROM/EEPROM memory 303; a central processing unit and multi port capability 304; a real time clock 305; one or more opto isolated inputs 306; a volt free relay output 307; a global position system engine 308; a modem communications module 309; and multiple serial communications ports 310.

Preferably the data capture device 5 is provided with an in-built recharge terminal, for providing power to the data capture device.

An advantageous feature of the data capture device is that the data capture device has its own self contained battery power supply which is independent of the general purpose battery of the vehicle. The data capture device

may be provided with a mounting 58 for attachment of the hand held terminal to the casing of the data capture device. If the vehicle is attacked, and the general purpose battery is de-connected, which may lead to power down of various vehicle sensors around the vehicle, the data capture device may continue to operate to record the hostile event, and optionally communicate the hostile event over the communications link to the data analyser. The security of a vehicle may be monitored by the data capture device.

For example where a vehicle is to be stolen, the general purpose battery may firstly be disconnected in order to avoid activating vehicle alarms; and then, once the alarms have been disabled by a hostile act, the general purpose battery may be re-connected to start the engine of the vehicle and drive the vehicle. As the internal battery supply of the data capture device is not disabled, the data capture device may record these events, and may be pre programmed to activate the ground position system (GPS) for continuous transmission of the vehicle position back to the analyser, and generate an "Event" or "Alarm" signal alerting an operator to the hostile event.

The global positioning system may utilise a conventional US Department of Defence satellite, to give a vehicle position accurate to 25 metres, anywhere on earth. The global positioning system may use information from four satellites to determine vehicle position, with a further two satellites being tracked in case of physical obstruction of the vehicle. A transmitter antennae may be provided, being a conventional antennae of small size, fitted to the truck.

Referring to figure 6 of the accompanying drawings, there is shown a hand held terminal for use in the monitoring apparatus. The hand held terminal comprises a casing 70, having a wand type bar code reader 71 for reading bar codes of, for example goods items, maps etc. a display screen 72, for displaying parameters or conditions relating to the vehicle or its load; a memory upgrade card 73 for upgrading an internal memory of the hand held terminal; and a keypad 74, which is preferably waterproof, for entering data into the hand held terminal. Preferably the hand held terminal is provided with internal rechargeable batteries, for example NiCad batteries. Entry of data via the keyboard may be made by "fast code" instructions, ie. a pre programmed instruction to enter data relating to a particular parameter or event. A connector for a databus is provided, preferably an RS 232 protocol and databus.

Referring to figure 7 of the accompanying drawings, a cradle 90 for the hand held terminal of figure 6 is shown. The cradle is suitable for mounting in the cab of the vehicle adjacent a driving position.

Various optional components which may be arranged to plug into the data capture device or hand held terminal are also shown. The optional components include a bar code wand 75 for reading bar codes of documents or labels; a radio/telecom modem 76; a printer 77; a bar code scanner or document scanner 78, and a label maker 79.

Also shown in figure 7 is a protective rubber sleeve 91, which may be provided with a carrying strap, for holding the hand held terminal. The may be provided with battery re-charging apparatus for re-charging the internal batteries at the hand held terminal.

The hand held terminal may be provided with a plurality of memory up-grade cards 92, for increasing the internal memory of the hand held unit in increments of, for example, up to 4 megabytes.

A specific method of operation of the data monitoring apparatus of figures 1 to 13 will now be described, in the context of a vehicle monitoring operation for a fleet of transport vehicles.

In use, the data capture device may continuously monitor various parameters or conditions relating to the vehicle or its load, via inputs from the input devices such as the hand held terminal, the radio or telecom modem, or the sensor inputs.

Typically, the data capture device may be pre programmed or pre configured for monitoring one or more parameters and/or conditions. Examples of parameters or conditions which may be monitored by the apparatus are listed in figure 8 of the accompanying drawings.

The data capture device is configured to report automatically, via the communications link, to the analyser device when either (i) a parameter data is input to the data capture device, which is outside a predetermined limit or range; and/or (ii) data relating to a change of condition of the vehicle or its load is input to the data capture device. In the case (i), the data capture device generates an "Alert" message to indicate that there is an exceptional condition of one of the sensed parameters, and in the case of (ii), the data capture device generates an "Event" message indicating that there is a significant change of condition of the vehicle, its load or its driver.

The data capture device monitors parameters read by the sensors, by receiving the input data from one or more of the sensors, comparing the data received for any particular parameter with the predetermined ranges or limits of acceptable data for that parameter; if the received data is within the preset range or limit, storing the received data without reporting to the analyser device, or if the received data is outside the predetermined limit or range for that parameter, the data capture device generates an Alert message to indicate that the data is an exceptional data for that parameter, which is outside the predetermined range or limit. The Alert message may be communicated to the driver, via the display on the hand held terminal, and/or to the Analyser device.

The parameters may comprise a selection from the following: engine on/off; alternator current/voltage; engine oil pressure; engine water temperature; tyre pressures; vehicle security; cargo security; cargo temperature; refrigeration unit operation; refrigeration unit oil pressure; refrigeration unit alternator; anti lock brake operation; electronic fuel control; transmission diff lock; transmission power take off; vehicle road speed; excessive or harsh vehicle braking; engine speed; engine running hours. However, any other physically measurable or sensed, and automatically monitorable parameter may be handled by the data capture device.

Such parameters may be suitably input to the data capture device by the sensor inputs.

The input device, eg. a hand held terminal and/or modem, and/or PC or computer memory storage device, may be used to program the data capture device unit with various

vehicle specifications, for example manufacturers engine and or chassis number; registration number; owner; supplier/dealer details; road fund tax licence category; recommended oil type, eg. synthetic/mineral; recommended tyre size; purchase price paid for vehicle.

The fleet owner or manager may additionally pre program preset data limits or ranges for the parameters.

Data about these parameters are then monitored by the data capture device in real time and are recorded continuously or at discrete regular intervals, together with a note of the time of reading and vehicle mileage, such that the data for each parameter is logged chronologically.

The chronologically collected data may then be compared with the preset limits or ranges, and if any parameter data exceeds the preset limit or range, the data capture unit may either raise an alarm, and/or transmit the parameter data which is outside the preset limits to the data analyser via the communications link.

Further information which may be logged into the memory of the data capture device may include the following: service interval; inspection interval; MOT test date; tachograph seal dates; emission test dates; anti freeze level test dates; for refrigeration unit test dates and performance data.

The data capture device may also contain emergency communications instructions, pre programmed therein, for allowing a vehicle alarm to be triggered upon receipt of an alarm signal from an alarm sensor, or via an alarm signal transmitted from the data analyser via the

communications link to the vehicle. The data capture unit may be pre programmed to make covert continuous broadcast of data relating to the vehicle position, for tracking of the vehicle. This may have an advantage of allowing covert monitoring of vehicle position if the vehicle is stolen.

The hand held terminal may have an internal memory which prompts the driver of the vehicle by display on a display screen of the terminal, when action is required, and warns the driver of any parameters which exceed preset limits.

The hand held terminal may be used to perform the following data input or data monitoring operations: enter an identification; view a service data; view a defect log; view an entries log; display a current location; display a current mileometer reading; carry out a driver check; display a vehicle defect log; display a trailer defect log; display a fuel record; display an oil record; display a coolant record; display route information; display a destination; display deliveries; display collections; display a weight check; enter and/or display expenses incurred; enter and/or display emergency numbers. Each of the aforementioned options may comprise a menu selection which is available to the driver, using the hand held terminal keypad.

Sub menus may allow for entry of; job number; VMRS codes; parts numbers, enabling generation of vehicle maintenance records in a paper free workshop environment.

Position information may be transferred from the global positioning system apparatus (GPS) into the data capture unit memory as frequently as required. The global

positioning system transmits the vehicle position via the communication link, to the data analyser, to allow the vehicle position to be tracked on an on screen map, generated by the software.

The communication link may enable both voice communication between the driver, and a remote location, at which the data analyser is kept and/or electronic data communication with the data capture unit and the remote location. Communications concerning only data (not voice) may be made at off peak times when the cost of using the communications network is low. The data capture unit may be programmed to allow voice calls to be made between the vehicle and the remote position and/or the vehicle and emergency services only, in order to increase security. All voice and/or data calls may be logged and timed.

Preferably the conventional Alcatel Eutel Tracs satellite system comprises the communications link, for embodiments of the monitoring apparatus intended for operation in Europe. The Alcatel Eutel Tracs satellite system may allow messaging on the display screen of the hand held terminal, but without voice communication. Further, the Eutel Tracs satellite may provide functioning equivalent to the global positioning system, for locating the vehicle.

A land based cellular radio communication link may be used as the communications link.

The data analyser unit, which is remote from the vehicle, and linked thereto by the communications link, is preferably a personal computer, programmed by software suitably of the "Windows"™ type. The software may be used

to set up the vehicle mounted equipment by pre programming in functions such as: setting descriptions of Alert messages, editing a vehicle log, setting limits for vehicle parameters, setting maintenance intervals for the vehicles; setting an identification code of the vehicle.

The software may operate to select a function by the following process.

Firstly a period, ie. a user selectable date range, may be entered for a particular function. Secondly, the vehicle registration or other identification number of a particular vehicle in a fleet to be addressed, is entered into the data analyser. Thirdly, the name of a depot to which the selected vehicle is attached is entered into the data analyser. Fourthly the weight category of vehicle is entered into the data analyser, and fifthly the manufacturer of the specific vehicle is entered into the data analyser. This process is used to set up each of the above mentioned set up functions including load descriptions, edit vehicle log, set limits, set maintenance intervals, or set identification codes.

Information from one or a plurality of vehicles in a fleet received by the data analyser may be displayed in various selectable formats. These formats include chronological listing, display of parameters which are exceptional (ie. outside the preset parameters), display of parameters in bar chart form, display of parameters in line graph or pie chart form.

A further display comprising a performance league table for drivers and/or vehicles according to selected categories may be made.

Referring to figure 9 of the accompanying drawings, there is shown an example of a screen display output of the data analyser concerning vehicle fuel. The output is in the form of a line graph, of time denoted in week number on the horizontal or X axis, versus vehicle miles per gallon on the vertical or Y axis. The display is for trunk vehicles attached to a depot in the town of Rotherham up to the period of week 18. The total miles travelled by the trunk vehicles in the period was 5818, and 788 gallons of fuel was consumed in that period. An overall average figure for the miles per gallon in the 18 week period to date is calculated by the software of the analyser to be 7.1 miles per gallon. The display also shows the budgeted figure of 7.5 miles per gallon, and a graphical display of the actual miles per gallon over the 18 month period (curved line in figure 9).

A fuel report for each vehicle in a fleet may be produced similar to that shown in figure 9, from data collected by the data capture units for each respective vehicle and transmitted to the data analyser, which is preferably a personal computer.

All analyser device screen based displays may be printed as hard copy by the data analyser (PC).

The analyser may also produce displays relating to viewable functions. Such viewable functions may include, a viewing of all Alert statuses for any particular vehicle or all vehicles, a viewing of any Events notified by a driver via the hand held terminal and data capture unit and transmitted to the data analyser, and viewing of any defects reported via the data capture unit and entered into the particular data capture unit of any one vehicle

by either the hand held terminal or any one or more of the vehicle sensors.

Apart from the above mentioned viewable functions, various functions may be analysable by the programmed analyser. Examples of such analysable functions are as follows: Alert analysis, for analysing any Alert signals received by the analyser; Event analysis for analysing any Event signals received by the analyser, for example events of loading/unloading vehicles or events of the vehicle being in motion or stationary; defect analysis, eg. incidences and frequency of low oil pressure, frequency of punctures; analogue analysis; fuel analysis, for example as shown in figure 13 of the accompanying drawings; communications analysis, for example dates and time of communications between the vehicle and analyser, for example for the purpose of checking that a driver is making the correct communications at the correct times, or to determine whether a driver needs to make a communication; maintenance analysis, for example analysis of amount and cost of engine oil consumed, frequency and cost of air filters, engine parts replaced; and driver hours analysis, for example analysis of tachograph readings, and/or analysis of hours driven by a particular driver for the calculation of overtime pay etc.

Further, various general functions may be provided by the analyser apparatus. An example of a general function is for example the capability of entering an emergency telephone number; a functions of performance relating to any particular vehicle, driver and/or both; a function of vehicle scheduling, viewed by year, month, week and/or day; the showing of operational analysis of workload, maintenance, MOT test dates or other vehicle related dates, percentage utilisation of vehicle and/or trailer;

and a function of vehicle position, categorised by country, region, town or road.

In the above, Alerts are automatically generated entries, whereas Events are generated by manual entry into the monitoring apparatus, for example by keyboard or by bar code generated entry.

The above data monitoring apparatus may operate to merely detect a fault, or to detect a parameter which is out of preset limits, without interceding with the parameter or taking any corrective action to directly change the measured parameter. For example, if a fault in the engine develops, which is reported to the data collection unit and analyser via an engine parameter sensor, the data monitoring apparatus will not stop the engine, but rather raise an alarm. If a warning alarm is raised, the warning may continue to display until the driver of the vehicle presses a button acknowledging that he is aware of the alarm condition.

Referring to figure 10 of the accompanying drawings, a first mode of deployment of the monitoring apparatus is shown schematically. In the first mode, the vehicle 100 may be on the road collecting and delivering goods. In an abbreviated version of the monitoring apparatus, suitable for deployment in the first mode, essential elements of the monitoring apparatus comprise the data capture unit 5, on board the vehicle, the hand held terminal 30, a bar code reader 103, and a vehicle mounted transmitter/receiver 104. In the first mode of deployment, the data monitoring apparatus may be used to perform the functions of entering bar codes from labels of goods loaded or unloaded into the data capture unit via the bar code reader 103 for transmission by the data

capture unit via the transmitter/receiver 104 to over the communications link to the data analyser at a remote depot.

The driver of the vehicle may input event messages via the hand held terminal 30, and event messages which are transmitted from the depot may be displayed on the screen of the hand held terminal 30.

Referring to figure 11 of the accompanying drawings, there is illustrated a second mode of deployment of the monitoring apparatus. Elements of the apparatus essential for deployment in the second mode include the data capture device 5 on board the vehicle; the hand held terminal 30, and an equipment connector 84.

In the second mode of deployment, being a maintenance mode, a maintenance mechanic or fitter may monitor parameters of the vehicle which have been stored in the data capture device, during operation of the vehicle, such as date of last oil filter change, amount of miles travelled since last service, etc. and may thus gain an appreciation of the required maintenance of the vehicle, by monitoring these parameters visually on the display screen of the hand held terminal. When the required maintenance has been carried out, the fitter may enter new, up dated parameters into the data capture unit via the hand held terminal. These parameters may be automatically transmitted to the analyser at a later time during a general data transmission operation.

Referring to figure 12 of the accompanying drawings there is shown a third mode of deployment of the monitoring apparatus. In the third mode, where the vehicle is being loaded with goods by for example a fork

lift truck, the hand held terminal 102 may be used to enter quantity and description of goods loaded, the information being entered into the data capture unit of the vehicle. In a depot or warehouse situation, a forklift driver may be provided with a hand held terminal 102 which may be connectable via one or a plurality of connectors 84 to one or a plurality of vehicles, so that the forklift truck driver can enter details of the goods loaded onto any particular vehicle via his own hand held terminal mounted on his forklift truck, communication between the hand held terminal on the forklift truck and the particular vehicle addressed by typing in for example the registration number on the hand held terminal, being made by means of a transmitter/receiver link.

Referring to figure 13 of the accompanying drawings, a fourth mode of deployment of the monitoring apparatus may be made. In the fourth mode, a hand held terminal 102 provided with a bar code pen scanner 103 for reading bar codes on goods loaded into a vehicle 200. A bar code may be recorded manually on the hand held terminal, and parts used may be identified with the bar code. The bar code data can then be transmitted to the main data analyser for immediate invoicing and parts re-ordering.

Referring to figure 14 of the accompanying drawings, a computer program is used to control the data capture device so that information can be analysed by the device. For example the device may analyse information relating to a read, date and time information, may read a GPS position data, may read a state of one or more digital sensors, reading a status of one or more analogue sensors, may check a modem for a communication, or check the hand held terminal for a communication. When the received information has been analysed by the data capture unit it

may be displayed as an alert signal on the hand held terminal, or stored. Alert information displayed on the hand held terminal may give rise to an option of re-displaying a hand held terminal menu or selected function. The data capture device may respond to a hand held terminal request such as a request to view a vehicle log, a request to view or set a data parameter limit, for example a speed or revs per minute limit, or to down load an Alert data.

Similarly, the data capture device may respond to a Modem Request for, example to display a message, to download Alert data or to send position information.

Referring to figure 15 of the accompanying drawings, the data capture device collects information from a plurality of vehicle sensors, can read tachograph information, and can get position information from the GPS. The data capture device can also receive function inputs from the hand held terminal. The data capture device analyses data and stores data to determine whether an Alert condition is present, and can store Alert data in an Alert memory. The data capture device may inform the vehicle driver of an Alert condition. The data capture device may transmit data via an RS 232 bus and communications link to the data analyser, which may be for example an IBM compatable personal computer. Data may be dumped into an RS 232 data dump serial at the data capture device, into a modem data connection data dump, or into a hand held terminal data dump before transmittal over the communication link to reception data dumps at the data analyser.

Referring to figure 16 of the accompanying drawings, there is shown a general overview a method for controlling

the hand held terminal. The method is implemented by a computer program.

The hand held terminal may communicate with the data capture device or the data analyser. The data analyser may be communicated with via a personal computer serial port.

Data stored in a data memory may be managed by the hand held terminal or communicated to the data capture device or the data analyser. Details of a vehicle log may be entered into the data capture device via the hand held terminal, and the hand held terminal can be used to set up the data capture device, for example by setting speed limits or setting RPM limits. The hand held terminal may be provided with a drivers log menu.

Referring to figure 17 of the accompanying drawings, the drivers log menu, which can be accessed via the hand held terminal, may provide for entering driver checks, providing a vehicle defect log, providing a trailer defect log, a fuel record, an oil record, a coolant record, route information, destination information, delivery information, collection information, weight check information, temperature checks, emergency number information. The drivers log menu can also be used to enter current kilometres travelled or anticipated to be travelled, entering a current location, viewing entries in the drivers log, viewing a defect log, viewing an alert log, being a log of alert conditions, viewing a service status, or logging off from the data capture device.

Referring to figure 18 of the accompanying drawing, features of a general arrangement of the operation of the data analyser are shown. Information is stored on a hard

disc data store. The information can be manipulated by a data management and storage program. The program can be used to select a communications port or communications method of the data analyser, to set up a user identification, and print out a hard copy of a user identification, to set up a vehicle log and print out a hard copy of their vehicle log, to set up a maintenance interval and print out a hard copy of the maintenance interval to set up a description of an Alert, and to set up parameters giving rise to Alerts, and giving a hard copy of such perameter set ups, and to communicate such set up conditions to the data capture device via the communications link.

Referring to figure 19 of the accompanying drawings, there is shown a method of analysing data by the data analyser. The method is carried out by an Analyser program to control a personal computer. As mentioned above, data is stored on the hard disc and parameters can be set up at the data analyser. A data management and storage program may enable the data analyser device to receive data via the RS 232 data dump reception, the data dump modem reception, and the HHT data dump reception. The data management and storage computer program provides a set of general functions, a set of view functions, a set of analysis functions, and a set of performance functions. For the general functions, hard copy may be provided for giving information on these general functions. Similarly for the view, analysis and performance functions, corresponding hard copy may be obtained via a printer for viewing the view functions, analysis functions and performance functions.

Referring to figure 20 of the accompanying drawings, the data management and storage program may also be used

to manage telephone numbers and produce telephone number hard copy. The telephone numbers may be transmitted to the data capture device and an on-line help system may be provided in the data management and storage program. Help system hard copy may be obtained. The data management and storage program may receive information from the global positioning system and display this on a continuously or intermittently up dated computer generated map, for example as provided by the "auto route" program which operates in "windows" software WINDOWS is a Trade Mark of Microsoft. AUTO ROUTE is a Trade Mark of Next Base Limited.

The data management and storage program may also allow option registration for future functions.

The data management and storage program is also provided with a schedule function, through which a schedule of, for example vehicle movements etc. may be viewed. The schedule movement may comprise a year view schedule, for viewing a yearly schedule, or a three month of a schedule, or a daily view of a schedule. In each case for the yearly, three month, or daily schedule hard copy may be output.

Referring to figure 21 of the accompanying drawings, the data management and storage program may allow viewing of Alert signals or conditions giving rise to Alert signals for example for viewing Alerts related to speed or revs per minutes measured on a tachograph of a vehicle. Hard copy of the Alerts may be obtained.

Similarly the data management and storage program may allow viewing of Defects or conditions giving rise to

defect signals. An analysis, or a detailed analysis of such Defects may be made on a hard copy or on screen.

Additionally, the data management and storage program may allow viewing of Events, or conditionally giving rise to Events. Events may be viewed on screen or on hard copy as required.

Referring to figure 22 of the accompanying drawings, there are shown in schematic form analysis functions of the data analysis device. The data management and storage program may provide functions for communications analysis, and log analysis, Defect analysis, Alert analysis, Event analysis, fuel analysis, or maintenance analysis. An example of a fuel analysis is shown with reference to figure 9 herein above.

The analogue analysis may be further analysed into a detailed analogue analysis. Similarly, the Defect analysis, Alert analysis, Event analysis and maintenance analysis may be further analysed in detail, and a hard copy of the detailed analysis in each case may be produced.

Referring to figure 23 of the accompanying drawings, the data management and storage program may allow for an analysis of driver hours, an analysis of driver performance, and an analysis of vehicle performance. As the driver performance and vehicle performance are often related, an analysis of vehicle and driver performance may be produced. Hard copy for each of the driver hours analysis, driver performance analysis, vehicle and driver performance analysis and vehicle performance analysis may be produced.

The above described embodiments may allow an advantage of providing a facility which allows monitoring of a network, system or apparatus such that when the network, system or apparatus is operating normally then Alert or Defect type alarm signals are not generated. However, if any part of the network system or apparatus which is being monitored operates outside its normal perameters, then this may give rise to an "exceptional" condition, resulting in an Alert or Defect alarm signal or other communication to allow management of the network, system or apparatus. Thus, a network, system or apparatus may be "managed by exception", eg. left to operate as normal with action being taken only when exceptional conditions occur.

Further, the above embodiments may advantageously provide for time and date stamping of recorded data, at the time of recordal, allowing improved accountability, audited traceability of data, and a verification of monitored perameters.

Although embodiments herein above have been described in relation to a vehicle data monitoring apparatus, other embodiments of the invention may be directed to the monitoring of medical intensive care units.

A further embodiment may be directed to monitoring of patients in ambulance vehicles, and may include means for monitoring patient parameters such as respiration, heartbeat, temperature, visual diagnosis data eg. dilated pupils. Such information may be communicated from the ambulance vehicle to for example a casualty unit prior to arrival of the ambulance.

Specific embodiments of the present invention may provide a data monitoring apparatus and improved method of operating fleets of vehicles, nationally or internationally. The embodiments may allow for increased utilisation of vehicles and consequent increased productivity of vehicle fleets.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any

novel one, or any novel combination, of the steps of any method or process so disclosed.

CLAIMS

1. A data monitoring apparatus comprising:

a data capture device for collecting data;

one or a plurality of data input means for inputting data into the data capture device; and

a data analyser device for analysing data collected by the data capture device.

2. A monitoring apparatus according to claim 1, further comprising a communications link for communicating data between the data capture device and the data analyser device.

3. A monitoring apparatus according to any one of the preceding claims, arranged to monitor data relating to one or a plurality of vehicles.

4. A monitoring apparatus according to any one of the preceding claims, which is capable of providing real time monitoring of data by:

(i) the data capture device substantially continuously receiving data from one or a plurality of said data input means; and

(ii) communications of collected data between the data capture device and the data analyser device occurring substantially continuously, and/or at discrete time intervals.

5. A monitoring apparatus according to claim 4, in which said time intervals are periodic.

6. A monitoring apparatus according to claim 4 or 5, arranged such that data is automatically input to said data capture means by said input means, and said communications between the data capture device and the data analyser device occur automatically.

7. A monitoring apparatus according to any one of the preceding claims, in which the data capture device is preset with a set of data ranges each data range corresponding to a parameter, the data capture device being arranged such that when a parameter data is received which is outside the preset range of data for that particular parameter, the received parameter data is communicated between the data capture device and the analyser device.

8. A monitoring apparatus according to any one of the preceding claims in which the data input means comprises a keypad terminal connectable to the data capture device by means of a databus.

9. A monitoring apparatus according to claim 8 comprising a display screen for displaying information transmitted between the keypad and data capture device.

10. A monitoring apparatus according to any one of the preceding claims in which the data input means comprises a bar code reader.

11. A monitoring apparatus according to any one of the preceding claims in which the data input means comprises

a portable personal computer or computer memory storage means.

12. A monitoring apparatus according to any one of the preceding claims in which the data input means comprises one or a plurality of sensors for sensing any one or more of the following physical parameters: pressure; temperature; speed; acceleration; deceleration; stress; strain; current; voltage; vibration; position; fuel level; oil level.

13. A monitoring apparatus according to any one of the preceding claims in which the data capture device is arranged to receive a plurality of sensor signals from one or a plurality of said parameter sensors.

14. A monitoring apparatus according to any one of the preceding claims in which the data capture device comprises a casing; a micro-processor; at least one memory; and an input/output terminal.

15. A monitoring apparatus according to any one of the preceding claims in which the data capture device is adapted for fitment to a vehicle.

16. A monitoring apparatus according to any one of the preceding claims in which the data capture device is adapted for fitment to a goods vehicle.

17. A monitoring apparatus according to any one of the preceding claims in which the data capture device is provided with an internal electrical power supply unit so that the data capture device may be powered independently of a general electrical power supply circuit of a vehicle to which the data capture device is fitted.

18. A monitoring apparatus according to any one of the preceding claims comprising means for determining a vehicle position.

19. A monitoring apparatus according to any one of the preceding claims as appendant to claim 7, in which the data analyser comprises a computer programmed for transmission of data to the data capture device via the communication link, and for receipt of data transmitted from the data capture device over the communications link; wherein the computer is arranged to automatically generate an Alert message, if a collected a parameter data is outside a preset range of parameter data limits.

20. A monitoring apparatus according to any one of the preceding claims in which the communications link comprises a conventional cellular telephone network link.

21. A data monitoring apparatus for a fleet of vehicles, the apparatus comprising:

a plurality of data capture devices provided one or more per each vehicle;

a plurality of data input means, at least one data input means per each vehicle, for entering data into the data capture devices;

a data analyser device; and

a communications link having a plurality of channels between the data analyser device and the data capture devices.

22. A method of monitoring a set of data parameters relating to one or a plurality of vehicles, the method comprising the steps of:

(i) pre-determining a set of data ranges, each range corresponding to a respective parameter;

(ii) reading a parameter data;

(iii) comparing said read parameter data with the corresponding range of data which has been predetermined for that particular parameter; and

(iv) if a said read parameter data is outside said predetermined data range, generating a signal, to notify that said parameter data is an exceptional parameter data.

23. A method according to claim 22, in which, when a said read parameter data falls outside a said corresponding predetermined range, indicating said parameter data is an exceptional parameter data, said exceptional parameter data is communicated between a vehicle and a remote site.

24. A method of operating a data monitoring apparatus according to any one of claims 1 to 21, comprising the steps of controlling a data capture device to:

(a) read any one or more of the following: date and time information; ground position information; state of digital sensor information; state of analogue sensor information; and/or

(b) check a modem for a communication and/or checking a hand held terminal for a communication; and/or

(c) analyse said information or communication, and depending upon a result of said analysis, displaying an Alert signal or responding to the modem communication, and/or responding the hand held terminal communication.

25. A method of operating a data monitoring apparatus according to any one of claims 1 to 21, the method comprising the steps of controlling a hand held terminal input means to:

(d) view or enter information relating to a status of a monitored vehicle, via a log menu program; or

(e) operate the hand held terminal to set up preset data parameters on the data capture device.

26. A method of operating a data monitoring apparatus according to any one of claims 1 to 21, comprising the steps of operating the data analyser device to:

(f) receive and/or communicate data to the data capture device via the communications channel; and

(g) set up preset parameters on the data capture device from the data analyser device, said preset parameters including any one or more of the following: an Alert description and parameter set up; a user identification set up;

a vehicle log set up; a maintenance interval set up; a selector communications port set up.

27. A method of operating a data monitoring apparatus according to any one of claims 1 to 21, comprising the steps of:

(h) operating the data analyser device to perform a general function, a view function, an analysis function, or a performance function, in which a said general function is selected from a set comprising the members: an on line help program; a telephone number storage and access program; a schedule program; an option registration program; or a global positioning information program; and

(i) operating the data analyser device to select a view function from a set comprising the members: a view Alert function; a view Defect function; a view Event function and the analysis function is selected from a set comprising the members: a communications analysis function; an analogue analysis function; a Defect analysis function; an Alert analysis function; an Event analysis function; a fuel analysis function; a maintenance analysis function; and

(j) operating the data analyser device to select a performance function from a set comprising the members: a driver hours function; a driver performance function; a vehicle performance function; a driver performance and vehicle performance function.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report)	Application number GB 9408652.7
Relevant Technical Fields (i) UK Cl (Ed.M) G4A AUXV (ii) Int Cl (Ed.5) G06F 15/74	Search Examiner MR S J PROBERT Date of completion of Search 21 JUNE 1994
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE: WPI	Documents considered relevant following a search in respect of Claims :- 3-27

Categories of documents

X:	Document indicating lack of novelty or of inventive step.	P:	Document published on or after the declared priority date but before the filing date of the present application.
Y:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	E:	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	&:	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	EP 0239066 A1	(COMPAGNIE GENERALE D'AUTOMATISME) See abstract	1-27
X	WO 90/09645 A1	(WARNERDALE) See abstract	1-27
X	US 5303163	(BROERING ET AL) See abstract	1-27
X	WPI Abstract Accession Number 92-116715/15 and FR 2665559 A (SOC GEN TRAV ELECT)		1-27
X	WPI Abstract Accession Number 85-244461/40 and FR 2559929 A (BELLETANTE)		1-27

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